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FROM THE
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FROM THE
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ANNUAL REPORT

OF THE

# BOARD OF REGENTS

OF THE

# SMITHSONIAN INSTITUTION,

SHOWING

THE OPERATIONS, EXPENDITURES, AND CONDITION
OF THE INSTITUTION

FOR THE

YEAR ENDING JUNE 30, 1890.

Pt. II.

# REPORT

OF THE

# U. S. NATIONAL MUSEUM.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1891.

~~49.9.12~~
LSoc 4681.16 *
24 April 1893.
Gift of
Smithsonian Institution.

FIFTY-FIRST CONGRESS, SECOND SESSION.

*Concurrent resolution adopted by the House of Representatives May* 27, 1890, *and by the Senate June* 17, 1890.

***Resolved by the House of Representatives*** (***the Senate concurring***), That there be printed of the reports of the Smithsonian Institution and of the National Museum, for the year ending 30th June, 1890, in two octavo volumes, 19,000 extra copies, of which 3,000 copies shall be for the use of the Senate, 6,000 copies for the use of the House of Representatives, 7,000 copies for the use of the Smithsonian Institution, and 3,000 copies for the use of the National Museum.

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# REPORT

OF THE

# U. S. NATIONAL MUSEUM,

UNDER THE DIRECTION OF

THE SMITHSONIAN INSTITUTION,

FOR THE

YEAR ENDING JUNE 30, 1890.

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# REPORT OF THE U. S. NATIONAL MUSEUM FOR THE YEAR ENDING JUNE 30, 1890.

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## SUBJECTS.

I. Report of the Assistant Secretary of the Smithsonian Institution, in charge of the National Museum, upon the condition and progress of the Museum.
II. Reports of the Curators.
III. Papers illustrative of the collections in the U. S. National Museum.
IV. Bibliography.
V. List of accessions.

U. S. NATIONAL MUSEUM,
UNDER DIRECTION OF THE
SMITHSONIAN INSTITUTION,
*Washington, October* 1, 1890.

**SIR:** I have the honor to submit herewith a report upon the present condition of the U. S. National Museum and upon the work accomplished in its various departments during the fiscal year ending June 30, 1890.

Very respectfully,

G. BROWN GOODE,
*Assistant Secretary, in charge U. S. National Museum.*

Prof. S. P. LANGLEY,
*Secretary, Smithsonian Institution.*

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# SECTION I.

## REPORT

UPON THE

## CONDITION AND PROGRESS OF THE U. S. NATIONAL MUSEUM DURING THE YEAR ENDING JUNE 30, 1890.

BY

G. BROWN GOODE,

ASSISTANT SECRETARY SMITHSONIAN INSTITUTION, IN CHARGE OF
U. S. NATIONAL MUSEUM.

# REPORT

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## A.—GENERAL CONSIDERATIONS.

In January, 1847, the first Board of Regents of the Smithsonian Institution, after many weeks of consultation and deliberation over the plans for its organization, unanimously voted the following resolution:

*Resolved, That it is the intention of the act of Congress, and in accordance with the design of Mr. Smithson, as expressed in his will, that one of the principal modes of executing the act and the trust, is the accumulation of collections of specimens and objects of natural history and of elegant art, and the gradual formation of a library of valuable works pertaining to all departments of human knowledge, to the end that a copious store-house of materials of science, literature, and art may be provided, which shall excite and diffuse the love of learning among men, and shall assist the original investigations and efforts of those who may devote themselves to the pursuit of any branch of knowledge.*[*]

[illegible] Museum, but it is one [illegible] it is

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[*] Report of Committee on Organization, p. xv.

## ERRATA.

Page 75, line 22, for "Sebright" read "Seabright."
Page 75, line 32, for "Madaagascar" read "Madagascar."
Page 82, line 14, for "daguerrotypes" read "daguerreotypes."
Page 156, line 3, for "Golzius" read "Goltzius."
Page 229, line 21, for "John Hopkins" read "Johns Hopkins."
Page 689, line 3 from below, for "Nation" read "National."
Page 720, line 11 from below, for "specimens" read "species."
Page 759, lines 32 and 33, for "mocasins" read "moccasins."

# REPORT

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This was a high ideal for the future National Museum, but it is one which it has been year after year more closely approaching, and it is hoped that the present report will show that the work accomplished during the fiscal year of 1889–'90 has brought us still nearer to its realization.

After the death of Professor Baird, in 1887, the Museum passed from under the direction of the mind by which its policy had been planned for many years. If his biography could be properly written, it would include a full history of the Museum as well as of the Fish Commission, and in minor degree of the Smithsonian Institution itself, for as Secretary and Assistant Secretary he was associated with nearly every phase of its activity during thirty-seven of its forty-one years of corporate existence. His relation to it was very similar to that held by Sir Henry Cole to the great national establishment at South Kensington in England, so well described in the volumes entitled "Fifty Years of Public Work," and recently published by his son, Mr. Alan Cole.

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[*] Report of Committee on Organization, p. 20.

Upon the firm foundation which he laid, his successors are endeavoring to build a superstructure, harmonious in plan, but, it may be, different in proportions and even in material. Their policy is not to work as he did, under circumstances different from those which now exist, but to work as he would have done under these changed circumstances.

## EARLY HISTORY OF THE MUSEUM.

The idea of a national museum in the city of Washington was first suggested by the Hon. Joel Roberts Poinsett, of South Carolina, Secretary of War under President Van Buren, who in 1840 organized, for the purpose of establishing such a museum, a society called "The National Institution," afterwards "The National Institute," which was exceedingly prosperous and active for four years. By this Society the nucleus for a national museum was gathered in the Patent Office building in Washington, and public opinion was educated to consider the establishment of such an institution worthy of the attention of the Government of the United States. In 1846, having failed in securing the public recognition at which it aimed, and the Smithsonian Institution being by its charter entitled to take possession of the extensive Government collections already assembled in its charge, the society became torpid, and eventually, in 1861, passed out of existence.

From 1844 to 1858, when the so-called "National Cabinet of Curiosities" passed into the charge of the Smithsonian Institution, the term "National Museum" was in disuse. From that time onward, however, it was used, unofficially, to designate the collections in the Smithsonian building.

After the "National Cabinet" was delivered to the Regents, appropriations were made by Congress for its maintenance. During the twenty-three years which followed, the collections were greatly increased and were made the subjects of numerous important memoirs upon the natural history and ethnology of America. The public halls, with their arrangements for the exhibition of a portion of the collection, also received a due share of attention, and a certain amount of instruction and pleasure was afforded to visitors. The appropriations, however, were meagre, the space limited, and the staff was so inadequate that little could be done except to keep the collections in good preservation.

The exhibition of 1876 in Philadelphia was an event of great educational importance to the people of the United States; and not the least of its benefits were the lessons it taught as to the possibilities for good in public museums. The objects which at the close of the Centennial were given to the United States for its National Museum, were of much intrinsic value, but were still more important in that they led to the erection of a large building for the expansion of the Museum itself.

From 1876 to 1881 was a period of quiet preparation for future effort. From 1881 to 1890 its growth has been rapid, though the organism is still in its infancy. These have been years of experiment, but it is hoped that it is now evident to the people and to Congress that the Museum has now begun a promising progress toward maturity.

## PROGRESS IN THE WORK OF THE MUSEUM.

Among the more important features of the work, up to the present time, certain definite steps of progress have been taken, among the most important of which may be mentioned:

(1) An organization of the Museum staff has been effected—efficient for present purposes and capable of expansion and extension as occasion may require.

(2) Through the agency of this staff, the materials in the Museum, the accumulations of nearly half a century, have been examined, classified, and brought under control.

(3) The collections have been fully quadrupled in extent.

(4) A considerable beginning has been made toward the development of a thoroughly labeled exhibition series, available for the instruction of the public.

(5) A thorough study of the organizations and systems of classification in other museums throughout the world has been made, the results of which are beginning to appear in the work of the Museum staff. A report upon the great museums of the world is in preparation.

(6) Many new methods of installation have been developed by experiments in the Museum, and in the expositions in which the Museum has participated. These are finding favor, and are being adopted in many similar establishments at home and abroad, and will certainly add to the economy and success of our own administration.

(7) Science has been forwarded by the publication of many hundreds of papers describing the materials in the Museum, while the work of specialists in the production of these papers has greatly improved the significance and value of the collections.

## NECESSITY FOR A NATIONAL MUSEUM.

That the United States must have a National Museum is so evident that the proposition needs no argument for its support.

Every considerable nation has a museum or group of museums in its capital city—centers of scientific and educational activity—the treasure-houses of the nation, filled with memorials of national triumphs in the fields of science, art, and industrial progress.

They are legitimate objects of national pride, for upon the character of its museum and libraries, intelligent persons visiting a country very properly base their judgment as to the nature and degree of the civilization of the people.

It should be borne in mind that here in Washington under the roofs of the Smithsonian and new Museum buildings are grouped together collections which in London, Paris, or any other of the European capitals are provided for in a group of museums, for accommodating which a much larger number of equally commodious buildings is found needful.

### POSSIBILITIES OF THE FUTURE.

It is possible, as I have pointed out in previous reports, to show that Washington may readily be made the seat of one of the greatest museums in the world. It will perhaps be neither practicable nor desirable to gather together in Washington collections of ancient mediæval art, such as those which adorn the capitals of Europe; but a representative series of such objects will undoubtedly grow up, which shall tend to educate the public taste, and to promote, so far as possible, the study of the elements of art and the history of civilization, as well as to forward the growth of the arts of design. This having been accomplished, the attention of the Museum should be directed mainly toward the exhibition of the geology and natural history of America, and its natural resources, to the preservation of memorials of its aboriginal inhabitants, and the exposition of the arts and industries of America.

It is evident that the National Museum of the United States will of necessity have features peculiar to itself, developed in response to the peculiar needs of the people of this continent. It should be remembered that the national collections of every principal European nation are divided into several groups, each under separate administration, though often within the general control of some central authority. In France, for instance, most of the museums are under the Ministry of Public Instruction, and in England, to a less extent, under the Department of Science and Art.

In the great European capitals the public collections are scattered through various parts of the cities, in museums with distinctive names and independent in their organizations. Much of the work which should properly be done by such museums is omitted, because no one of them has seen fit to undertake it; while, on the other hand, much labor is duplicated, which is perhaps equally unfortunate, collections of similar scope and purpose being maintained in different parts of the same city. One of the chief objections to such division of effort is that much of the value of large collections in any department is lost by failure to concentrate them where they may be studied and compared side by side. In Washington the national collections are all, without exception, concentrated in one group of buildings. The Army Medical Museum now occupies a building side by side with those under the control of the Smithsonian Institution, and this proximity, in connection with the long-established policy of coöperation between the two organizations, will cause them to be, for all practical purposes, united in interest.

## POSSIBILITIES OF INCREASE AND IMPROVEMENT.

Although the appropriations from the public treasury for the maintenance of a national museum are small, compared with those in several European countries, the value of objects given by private individuals is proportionately larger. The actual value of such contributions for ten years past, has not, it is estimated, fallen short of $20,000 a year, and in some years has been greater.

Among the more important gifts may be mentioned the George Catlin Indian gallery, of inestimable value to the American historian and ethnologist; the Riley collection of North American insects, the finest in existence, containing 150,000 specimens, and easily worth $50,000; the collection bequeathed in 1887 by the late Isaac Lea, of Philadelphia, containing besides minerals and other objects, about 20,000 conchological specimens, and appraised by the State at $10,000; and the collection of the American Institute of Mining Engineers, for the transfer of which from Philadelphia to Washington, a special appropriation was made by Congress.

Some exceedingly valuable collections in this country and in Europe have been bequeathed to the Smithsonian Institution which have not yet come into its possession. Within the past ten years it is estimated that individuals to the number of at least a thousand have made gifts to the museum to the value of $100 or more.

Not a day passes during which some stranger, pleased with the work of the Museum, does not voluntarily send in some contribution more or less important.

The National Museum now contains nearly 3,000,000 specimens, distributed among the various departments, as is shown in the table on page 22.

The late Professor Baird was once asked whether the value of the collections in the National Museum was equal to the amount which had been expended in its maintenance. He replied, unhesitatingly, that although it would be by no means a fair criterion of their value, he did not doubt that by a judicious and careful system of sale the entire sum could be recovered.

One of the most striking features in the affairs of the Museum is the manner in which its collections are increasing.

In 1887 the number of specimens was more than ten times as great as five years before.

In the last fiscal year more than twenty eight thousand new lots or groups of specimens were entered upon the Museum catalogue.

This increase, as has been shown, is in large degree spontaneous, only a small amount of money being available for the purchase of new material.

As might be supposed, a considerable proportion of the objects given duplicate material already on hand, and although these contributions can with the utmost advantage be used for distribution to other museums and schools, they do not increase as much as is desired the value of the collections for study by specialists, and for general educational purposes. The need of a larger fund for the purchase of specimens is yearly more manifest. Exceedingly important material is constantly offered to us at prices very much below what it would cost to obtain it by collecting, and in many instances, when refused, it is eagerly taken by the museums and institutions of Europe.

The most enlightened nations of Europe do not hesitate to spend money liberally to promote the interests of their national museums.

For the purchase of specimens for the South Kensington Museum from 1853 to 1887 $1,586,634 was expended; or a yearly average of nearly $47,000.

Toward her other museums England is equally liberal. Exact statistics are not at hand, but it is quite within bounds to assert that her average expenditure for the purchase of new objects for museums in London is not less than $500,000 a year.

The museums of England are rich with the accumulations of centuries. The National Museum of the United States is young and has enormous deficiencies in every department. It needs, more than any museum in Europe, the opportunity to increase its resources through purchase. The total amount expended for the purchase of specimens for the National Museum since its foundation has not exceeded $20,000, and never in one year more than $8,500.

More has been expended for the improvement of two museums in the city of New York in the past four years than has ever been expended by the general government upon the Museum in Washington.

Within the past year three mortifying instances have occurred of the inability of the National Museum to buy specimens needed to complete its collections.

A very valuable collection of minerals, absolutely essential to the national collections and for some years on deposit in the National Museum, was withdrawn by its owner and placed in a school museum in a neighboring city, because $4,000 could not be had for its purchase—a sum far below its value.

A collection of implements and weapons illustrating the history of the natives of Alaska, gathered by an officer in the U. S. Navy, and almost indispensable for the completion of the national ethnological collection, was sold to a museum in a neighboring city for $12,000, while the National Museum had no money to expend for such objects.

One of the most important collections of birds in America, the loss of which was a national misfortune, was taken from the city of Washington and sold to the British Museum for $10,000, no American institution having money available for its purchase.

Instances of this kind occur nearly every month in every year.

The National Museum has had the option for several years of the purchase at cost of $80,000 of a collection of minerals, which once acquired would enable its mineralogical department to rank among the first in the world. Congress has never been asked to make an appropriation for its purchase, simply because of unwillingness to ask for that which might not be granted. Minerals, having a money value, can readily be sold, and are not very often given to the Museum, and the poverty of its mineralogical collection is by no means creditable to the nation.

The Museum receives many valuable gifts from Government officials abroad, especially from those in the consular and diplomatic service, and in the Navy.

If the actual cost of gathering specimens could be paid, the time and experience of these men would gladly be given gratuitously. In this way, by the expenditure of a few thousands each year, extensive and important additions might be made to the national collections.

### THE NECESSITY FOR A NEW MUSEUM BUILDING.

The National Museum is now approaching an important crisis in its history. Its future will depend upon the action of Congress in granting it an additional building, for without more room its growth can not but be in large degree arrested.

The necessity for additional room is constantly increasing, and several of the collections, to wit, transporation and engineering, fishes, reptiles, birds' eggs, mollusks, insects, marine invertebrates, vertebrate and invertebrate fossils, fossil and recent plants, are in some instances wholly unprovided for, and in others only in a very inadequate degree.

In the main hall of the Smithsonian building is still exhibited the collection of birds. A few cases containing birds' eggs and shells have recently been arranged along the center of this hall.

Eleven of the departments in the National Museum have no space assigned to them in the Museum building, solely on account of its crowded condition. The collection of prehistoric anthropological objects remains installed on the second floor of the Smithsonian building. The collections of the remaining ten departments can not be exhibited or even properly arranged and classified without more room. These collections are at present stored in the attics and basements of the Smithsonian and Armory buildings, and are inaccessible for study and for the other purposes for which they were obtained. The specimens comprising these collections are not simply objects of natural history, possessing an abstract interest to the student, but represent the application of natural objects to the industries, and, as such, are of great importance. There are several collections of ores, minerals, building-stones, and of objects representing various arts and industries, which are of very great value, since they furnish to the American manufacturer and designer information of inestimable importance.

The increase in the national collections during the last eight years may perhaps be best described by the statement that in 1882 the total number of specimens recorded in the Museum was about 183,000; while in 1890 the records indicated the possession of nearly 3,000,000 specimens. It is proper to say in this connection that the actual increase was not so great as shown by the records, since during this period a large amount of material previously received had been brought under control and placed on the books of the Museum. It should also be borne in mind that the present Museum building was planned with reference to the reception of the material in its custody at the time of its construction.

In the Armory building there are at the present time several hundreds of boxes containing valuable material which has never been unpacked, since there is no space available for the display of the specimens. Many of the boxes contain collections which were brought to the Museum through the medium of special acts of Congress.

Independently of the collections obtained at expositions, a very large amount of material has been received from foreign Governments, among which may be mentioned those of Mexico, Central America, several of the South American states, and Japan, which have made extensive contributions to the zoölogical, geological, ethnological, and technological collections.

## APPRECIATION BY FOREIGN NATIONS.

The new methods of work and of museum arrangement, which have grown up here, have attracted much attention abroad. Mexico, in 1887, sent the entire collections of the National Natural History Museums, then just being founded, to Washington, in charge of two of her principal naturalists, who passed six months at the National Museum identifying their material and studying the methods of administration. Costa Rica, forming a national museum, sent its director here for a six months' course of study.

Japan has sent the entire national collection of birds to the Museum to be studied and reported upon by one of the naturalists of the Museum staff.

Germany has been supplied with a complete set of plans and illustrations of methods of administration at the request of the Director of the National Zoölogical Museum.

In 1883, at the Fisheries Exhibition in London, the methods of the National Museum were strictly adhered to in the arrangement of the display made by the United States.

In 1888, in his address as president of the Anthropological Society of the British Association for the Advancement of Science, General

Pitt-Rivers said that the American display at the Fishery Exhibition was the only thing done in the true spirit of modern science in the whole series of professedly scientific exhibitions held in London within the past six years.*

Such expressions of opinion, coupled with the constant praise with which European journals speak of the scientific work of our Government departments, can not but be gratifying, and it should be a matter of national pride to merit it.

## THE RELATIONS OF THE MUSEUM TO THE SMITHSONIAN INSTITUTION.

The Smithsonian Institution, though it bears the name of a private citizen and a foreigner, has been for nearly half a century one of the principal rallying points of the scientific workers of America. It has also been intimately connected with very many of the most important scientific undertakings of the Government.

Many wise and enlightened scholars have given to its service the best years of their lives, and some of the most eminent scientific men, to whom our country has given birth, have passed their entire lifetime in work for its success. Its publications, six hundred and seventy in number, which when combined make up over one hundred dignified volumes, are to be found in every important library in the world, and some of them, it is safe to say, on the working-table of every scientific investigator in the world who can read English.

Through these books, through the reputation of the men who have worked for it and through it, and through the good accomplished by its system of international exchange, by means of which within the past thirty-eight years more than 1,300,000 packages of books and other scientific and literary materials have been distributed to every region of the earth, it has acquired a reputation at least as far-reaching as that of any other institution of learning in the world.

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* The words of General Pitt-Rivers in 1888 are simply a repetition of what he said in 1883, made stronger by the observations of five more years of exhibitions in Europe.

In 1883 he wrote to the London Times:

SIR: In confirmation of the praise you justly bestow on the arrangement of the United States department in the Fisheries Exhibition I beg to draw attention to the fact that in the whole exhibition it is the only one which is arranged historically. In the Chinese, Japanese, Scandinavian, and Dutch courts there are objects which the scientific student of the arts of life may pick out and arrange in the proper order in his own mind; but in that of the United States, following the method adopted in the National Museum in Washington, there has been attempted something more—to bring the department into harmony with modern ideas. This gives to the exhibition an interest which is apart from commerce, and an interest which is beyond the mere requirements of fish culture, and it may be regarded as one out of many indications of the way in which the enlightened Government of the United States mark their appreciation of the demands of science.

I have the honor to be, sir, yours obediently,

A. PITT-RIVERS.

It is therefore representative of what is deemed in other lands the chief glory of this nation, for whatever may be thought in other countries of American art, of American literature, American institutions generally, the science of America is accepted without question as equal to the best.

In the scientific journals of Great Britain and other European countries, the reader finds most appreciative reviews of the scientific publications of the Smithsonian, the Museum, the Bureau of Ethnology, the Geological Survey, the Department of Agriculture, and the Fish Commission, and they are constantly holding up the Government of the United States, as an example to their own, of what governments should do for the support of their scientific institutions.

It is surely a legitimate source of pride to Americans that their work in science should be so thoroughly appreciated by eastern nations, and it is important that the reputation should be maintained. Nothing can be more in consonance with the spirit of our Government, nor more in accord with the injunction of Washington in his "Farewell Address," lately admiringly quoted by Sir Lyon Playfair in his address as president of the British Association for the Advancement of Science:

*Promote, then, as an object of primary importance, institutions for the general diffusion of knowledge.*

*In proportion as the structure of a government gives force to public opinion it should be enlightened.*

No one has been able to show why Smithson selected the United States as the seat of his foundation. He had no acquaintances in America, nor does he appear to have had any books relating to America except two. Rhees quotes from one of these ["Travels through North America," by Isaac Weld, secretary of the Royal Society] a paragraph concerning Washington, then a small town of 5,000 inhabitants, in which it is predicted that "the Federal city, as soon as navigation is perfected, will increase most rapidly, and that at a future day, if the affairs of the United States go on as rapidly as they have done, it will become the grand emporium of the West, and rival in magnitude and splendor the cities of the whole world."

Inspired by a belief in the future greatness of the new nation, realizing that while the needs of England were well met by existing organizations such as would not be likely to spring up for many years in a new, poor, and growing country, he founded in the new England an institution of learning, the civilizing power of which has been of incalculable value. Who can attempt to say what the condition of the United States would have been to-day without this bequest?

In the words of John Quincy Adams:

*Of all the foundations of establishments for pious or charitable uses which ever signalized the spirit of the age or the comprehensive beneficence of the founder, none can be named more deserving the approbation of mankind.*

The most important service by far which the Smithsonian Institution has rendered to the nation has been that from year to year, since 1846—intangible but none the less appreciable—by its constant coöperation with the Government, public institutions and individuals in every enterprise, scientific or educational, which needed its advice, support or aid from its resources.

There have been, however, material results of its activities, the extent of which can not fail to impress anyone who will look at them; the most important of these are the *Library* and the *Museum*, which have grown up under its fostering care.

The library has been accumulated without aid from the treasury of the United States; it has, in fact, been the result of an extensive system of exchanges, the publications of the Institution having been used to obtain similar publications from institutions of learning in all parts of the world.

In return for its own publications the Institution has received the books which form its library.

This library, consisting of more than a quarter of a million volumes and parts of volumes, has for over twenty years been deposited at the Capitol as a portion of the Congressional Library, and is constantly being increased. In the last fiscal year more than twenty thousand titles were thus added to the national collection of books.

Chiefly through its exchange system the Smithsonian Institution had, in 1865, accumulated about forty thousand volumes, largely publications of learned societies, containing the record of the actual progress of the world in all that pertains to the mental and physical development of the human family, and affording the means of tracing the history of at least every branch of positive science since the days of revival of letters until the present time.

These books, in many instances presents from old European libraries, and not to be obtained by purchase, formed even then one of the best collections of the kind in the world.

The danger incurred from the fire of that year, and the fact that the greater portion of these volumes, being unbound and crowded into insufficient space, could not be readily consulted, while the expense to be incurred for binding, increase of shelf-room, and other purposes connected with their use threatened to grow beyond the means of the Institution, appear to have been the moving causes which determined the Regents to accept an arrangement by which Congress was to place the Smithsonian library with its own in the Capitol, subject to the right of the Regents to withdraw the books on paying the charges of binding, etc. Owing to the same causes (which have affected the Library of Congress itself) these principal conditions, except as regards their custody in a fire-proof building, have never been fulfilled.

The books are still deposited chiefly in the Capitol, but though they have now increased from 40,000 to fully 250,000 volumes and parts of volumes, and form one of the most valuable collections of the kind in existence, they not only remain unbound, but are in a far more crowded and inaccessible condition than they were before the transfer. It is hardly necessary to add that these facts are deplored by no one more than by the present efficient Librarian of Congress.

The purchasing power of the publications of the Institution, when offered in exchange, is far greater than that of money, and its benefit is exerted chiefly in behalf of the National Library, and also to a considerable extent in behalf of the National Museum.

The amount expended during the past forty years from the private fund of the institution in the publication of books for gratuitous distribution has been $365,000, a sum more than half as great as the original Smithson bequest.

These publications have had their influence for good in many ways, but in addition to this, a library much more than equal in value to the outlay has through their buying power come into the possession of the nation.

In addition to all this, a large amount of material has been acquired for the Museum by direct expenditure from the private fund of the Smithsonian Institution. The value of the collections thus acquired is estimated to be more than equal to the whole amount of the Smithson bequest.

The early history of the Museum was much like that of the library. It was not until 1858 that it became the authorized depository of the scientific collections of the Government, and it was not until after 1876 that it was officially recognized as the National Museum of the United States.

But for the provident forethought of the Smithsonian Institution, the United States would probably still be without even a reputable nucleus for a National Museum.

The relations of the Museum to the system of popular lectures, for many years established in Washington, and the assistance which it affords each year to students of science, is referred to elsewhere in this report.

The Institution publishes many circulars, giving information on scientific subjects, which are distributed gratuitously to those who write to make inquiries, and this system is being continually extended. In addition to this, a large correspondence is carried on with people in search of information on scientific topics. Probably three thousand letters a year go out to people who write seeking to know the name of some object, or other scientific fact. Inquiries of this kind are always answered promptly and fully, and frequently, to intelligent inquirers, books are sent, which will enable them to find out such names for themselves in future. This work has not only an educational value but often a great economic importance as well; as, for instance, when some common mineral has been mistaken for one of value; some useless plant has been wrongly identified and supposed to be of service in medicine, or some harmless animal feared as noxious.

The publications of the Institution and its dependencies reach every State and almost every county in the United States. A careful study of the subject made two or three years ago by the president of one of the scientific societies in Washington seems to indicate that there are several States which are reached by no scientific publications whatever except those distributed gratuitously by the Government.

Speaking of the Smithsonian Institution proper, and not of the Museum or any other trust that it administers, it may be stated that nothing could be so desirable for the Institution as that Congress should examine for itself whether, on the whole, in the execution of the trust of Smithson, more has been given to the Government than has been received; for if, in attempting to increase and diffuse knowledge among mankind, the machinery of the Institution's action has been such that it has incidentally paid over to the Government the equivalent of much more than the whole original fund, these facts should surely be known to those who have to ask themselves in what spirit as well as for what purpose the Institution expends money placed in its charge.

Professor Langley has pointed out that "although by the judicious administration of the Smithson fund nearly a million and a half dollars—the fruits of its investment—have been applied during the past forty years to the advancement of science and education in America (in addition to the principal, $703,000, larger now than ever before) it should be remembered that the income of the Institution is only $42,000 a year, a sum much smaller in its power to effect results than ever in previous years."

Can the United States fail to recognize its obligation to supplement liberally this private contribution for public good, especially if it be borne in mind that, as Professor Langley has recently shown, the Institution has left in perpetual charge of the nation, in the Museum alone, property acquired out of its private fund (and to which it has apparently the same title) which is probably now more than equal in value to the whole amount of the Smithsonian bequest?

## THE EDUCATIONAL WORK OF THE MUSEUM.

The work of the Museum, if it only performed the functions of an institution for scientific investigation, would be of sufficient value to justify its maintenance and extension.

As a matter of fact, it not only performs these functions but also does a very great deal to render the resources of science available to the public at large.

Professor Huxley's definition of a museum was that it is "a consultative library of objects."

The National Museum is a consultative library for the scientific man, and it is something more. It aims to be an agency for the instruction of the people of the whole country, and to keep especially in mind the needs of those whose time is not devoted to the study of science.

The spirit in which the work of the Museum is being carried on was voiced in the address of one of its officers before the American Historical Association at its recent meeting in this city, in which it was said:

(1) *That public institutions of this kind are not intended for the few, but for the enlightenment and education of the masses.*

(2) *That the public has a right to full participation in the results of the work of the scientific establishments which they are helping to maintain.*

(3) *That one of the chief duties of the officers of these institutions is to provide means by which such results may be presented in an attractive as well as an intelligible form.*

No scientific institution is more thoroughly committed to the work of the diffusion of knowledge than is the Smithsonian Institution, and no department of its activity is more capable of usefulness in this direction than is the National Museum.

The benefits of the Museum are extended not only to the specialists in its laboratories and to the hundreds of thousands of visitors from all parts of the United States who pass its doors each year, but to local institutions and their visitors throughout the country.

In accordance with long-sanctioned usage, the duplicate specimens in the Museum are made up into sets and distributed to schools and museums, accurately named, and of great service, both for museum and class-room use.

The reports of the Smithsonian Institution will show how many hundred thousands of objects have been thus distributed during the past twenty-two years. Every museum in the United States has profited in this way, and by its system of exchange the Museum has, while enriching itself, contributed largely to the stores of every important scientific museum in the world.

Not only are specimens thus sent out, but aid is rendered in other ways. Within the last few years a large number of local museums in the United States have been supplied with working plans of cases in use in the Museum, and similar sets of plans have been supplied within the past few years to national museums in other countries.

Not only do the people of the country at large profit by the work of the Smithsonian, as made available to local institutions, but they profit directly, and personally to a very considerable extent.

The curator of each department in the Museum is expected to be an authority in his own line of work, and the knowledge of the whole staff of experts is thus placed without cost at the service of every citizen.

## B.—ORGANIZATION AND SCOPE OF THE MUSEUM.

The National Museum is under the direction of the Smithsonian Institution, which is governed by an establishment consisting of the President of the United States and his Cabinet, the Commissioner of Patents, and the Board of Regents, which latter is composed of the Vice President of the United States, Chief Justice of the United States, three members of the Senate, three members of the House of Representatives, and six other citizens not members of Congress, two of whom are residents of the city of Washington.

The Secretary of the Smithsonian Institution is by law the "keeper of the collections." The staff at the present time is composed of the Assistant Secretary of the Smithsonian Institution in charge of the National Museum and thirty-two curators and acting curators, twenty-two of whom receive no salary from the Museum appropriation. There are also eleven administrative departments.

### PRINCIPAL SOURCES OF THE COLLECTIONS.

The collections of the Museum are made up, in large part, of the following materials:

(1) The natural history and anthropological collections, accumulated since 1850 by the efforts of the officers and correspondents of the Smithsonian Institution.

(2) The collections of the Wilkes exploring expedition, the Perry expedition to Japan, and other naval expeditions.

(3) The collections of the scientific officers of the Pacific Railroad survey, the Mexican boundary survey, and of the surveys carried on by the Engineer Corps of the Army.

(4) The collections of the United States geological surveys under the direction of United States geologists Hayden, King, and Powell.

(5) The collections of the U. S. Fish Commission.

(6) The gifts by foreign governments to the Museum or to the President or other public officers of the United States, who are forbidden by law to retain such gifts in their private possessions.

(7) The collections made by the United States to illustrate the animal and mineral resources, the fisheries, and the ethnology of the native races of the country on the occasion of the International Exhibition at Philadelphia in 1876, the fishery collections displayed by the United States at the International Fisheries Exhibition at Berlin in 1880 and at London in 1883, and the collections obtained from various local expositions, as for instance the New Orleans Cotton Centennial Exposition in 1884 and 1885 and the Cincinnati Exposition in 1887.

(8) The collections given by the governments of the several foreign nations, thirty in number, which participated in the exhibition at Philadelphia in 1876.

(9) The industrial collections given by numerous manufacturing and commercial houses of Europe and America, at the time of the Philadelphia Exhibition and subsequently.

(10) The material received, in exchange for duplicate specimens, from the museums in Europe and America, at the time of the Philadelphia Exhibition and subsequently.

(11) Collections received as gifts, deposits, or in exchange, from individuals, numbering usually from a thousand to fifteen hundred each year.

## C.—SPECIAL TOPICS OF THE YEAR.

### THE PROPOSED STATUE IN MEMORY OF PROFESSOR BAIRD.

On February 10, 1888, a bill passed the Senate making an appropriation for the erection of a bronze statue in memory of Professor Baird. This bill was referred, in the House of Representatives, to the Committee on the Library, but was not reported. On February 11, 1889, an amendment was proposed by Hon. Justin S. Morrill to the sundry civil bill for 1889-'90, in the following words:

> That the Regents of the Smithsonian Institution be, and are hereby, authorized to contract for a statue in bronze of Spencer F. Baird, late Secretary of the Smithsonian Institution, to be erected upon the grounds in front of the National Museum; and for this purpose, and for the entire expense of the foundation and pedestal of the monument, the sum of fifteen thousand dollars, or so much of said sum as may be needed, is hereby appropriated, out of any moneys in the Treasury not otherwise appropriated.

On January 13, 1890, Hon. Justin S. Morrill introduced a bill (S. 1940) having the same object in view. This was read twice and referred to the Committee on Public Buildings and Grounds. On the following day the bill was reported by Mr. Morrill without amendment.

### ADDITIONAL FIRE-PROOF BUILDING.

On February 19, 1890, Hon. Justin S. Morrill reported from the Committee on Public Buildings and Grounds a bill (S. 2740) to provide for the erection of an additional fire-proof building for the use of the National Museum. This was read the first and second times by unanimous consent.

### THE AMERICAN HISTORICAL ASSOCIATION.

The American Historical Association was founded in 1884, for the promotion of historical studies; for the collection and preservation of historical manuscripts, and for kindred purposes in American history. By act of Congress, approved January 4, 1889, the Regents of the Smithsonian Institution were authorized to permit the Association to deposit its collections in the Smithsonian Institution or in the National Museum. Under this act the Association reports to the Smithsonian

Institution concerning its proceedings and the condition of historical study in America. The first report of the Association, for 1889, was transmitted to Congress June 16, 1890, and will be published as Senate Miscellaneous Document No. 170.

## OPENING OF THE NATIONAL MUSEUM AND SMITHSONIAN BUILDINGS DURING EXTRA HOURS.

On December 20, 1889, Hon. W. H. Crain, M. C., introduced a bill (H. R. 3341), requiring the National Museum and Smithsonian buildings to be kept open to the public from 10 a. m. to 5 p. m. during the months of November to March inclusive; and from 11 a. m. to 6 p. m. during the remaining months of the year. This was read twice, referred to the Committee on Public Buildings and Grounds, and ordered to be printed. No further action has yet been taken by Congress. A new bill (H. R. 7671), having in view practically the same object, and also providing for an electric plant for lighting the Museum, was introduced later in the session by Hon. W. H. Crain, and referred to the Committee on the Library.

## COLLECTION TO ILLUSTRATE THE COMPARATIVE HISTORY OF RELIGION.

A collection of objects used in connection with the public and private ceremonies of the Jews is being formed under the supervision of Dr. Cyrus Adler. One case of objects relating to this subject is already on exhibition. Many of them were obtained for the Museum by Dr. H. Friedenwald. Among the specimens exhibited are, a manuscript copy of the Pentateuch; a silk taleth; phylacteries of various sizes; a silver spice-box; a manuscript copy of a tablet on which is kept a reckoning of time between Passover and Pentecost: a shofar, or ram's horn; a manuscript roll of Esther; a lamp of brass, and many objects pertaining to domestic worship.

## THE CAPRON COLLECTION.

In the report for 1888 (p. 19) reference is made to the introduction of a bill into the Senate by Hon. Daniel W. Voorhees, providing for the purchase of the collection of lacquers, bronzes, carved ivories, coins, and other works of art obtained in Japan by the late Gen. Horace Capron. The bill was favorably acted upon in the Senate, but did not come to a vote in the House of Representatives. A new bill (No. 321) was introduced into the Senate on December 4, 1889, by Hon. Daniel W. Voorhees, for the same purpose. It was referred to the Committee on the Library, whence it was reported favorably, and passed the Senate March 29, 1890. The amount appropriated was $14,675. This bill was favorably reported by the House committee also on May 19, but has failed to pass the House during the first session of the Fifty-first Congress.

## GROWTH OF THE COLLECTIONS.

The accession records on June 30, 1890, showed 23,340 entries, representing an estimated total of nearly 3,000,000 specimens. Of this number, 13,451 accessions have been received since 1881. The average number of entries of accessions received annually between 1881 and 1890 has been 1,495.

## VISITORS TO THE MUSEUM.

The total number of visitors to the National Museum up to June 30, 1890, since the opening of the Museum building in 1881, is 2,111,949.

## SATURDAY LECTURES.

The first lecture of the first series of these lectures was given on March 11, 1882. In all, 103 lectures have been delivered in nine courses, the date of the last being April 3, 1890.

## MUSEUM APPROPRIATIONS FOR 1890-1891.

| | |
|---|---|
| For preservation of collection | $140,000 |
| For furniture and fixtures | 25,000 |
| For heating and lighting | 12,000 |
| For printing and binding | 10,000 |
| For postage stamps, etc | 500 |
| Total | 187,500 |

## THE HISTORY OF ENGINEERING.

At the Annual Convention of the American Society of Civil Engineers, held at Seabright, New Jersey, June 20-26, the following preamble and resolution were unanimously adopted:

Whereas the authorities of the Smithsonian Institution have established in the National Museum at Washington a department devoted to the preservation of the history of American engineering science—

*Resolved*, That the American Society of Civil Engineers hereby expresses its gratification at the establishment by the Smithsonian Institution, with the authority of the General Government, of a department in the National Museum for the preservation of objects of interest bearing upon the history of American engineering, and recommends that American engineers coöperate with the Smithsonian Institution in furthering the objects for which the Department of Engineering has been established.

*Resolved*, That copies of this resolution be sent to the Secretary of the Smithsonian Institution and to the Curator of the Engineering Department of the National Museum.

## D.—THE CONDITION OF THE COLLECTIONS.

### CENSUS OF THE COLLECTIONS.

The additions to the collections during the year are indicated in the following table:

| | No. of specimens. |
|---|---|
| **Arts and industries:** | |
| Materia medica | *200 |
| Foods | 200 |
| Textiles | 66 |
| Fisheries | 2 |
| Animal products | 1 |
| Domestic animals (for mounting) | 66 |
| Historical collections, coins, medals, paper-money, etc. | †5,900 |
| Musical instruments | 20 |
| Transportation and engineering | 1,250 |
| Modern pottery, porcelain, and bronzes | 121 |
| Paints and dyes | 88 |
| Physical apparatus | 12 |
| Chemical products | 211 |
| Graphic arts | 600 |
| Ethnology | 2,506 |
| American aboriginal pottery | 1,047 |
| Oriental antiquities | 2,635 |
| Prehistoric anthropology | 7,205 |
| Mammals (skins and alcoholics) | 561 |
| Birds | 2,245 |

| | | No. of specimens. |
|---|---|---|
| Birds' eggs | | 1,068 |
| Reptiles and batrachians | | 645 |
| Fishes | | 15,225 |
| Vertebrate fossils | | 512 |
| Mollusks | | 3,500 |
| Insects | | 15,000 |
| Marine invertebrates | | 4,700 |
| Comparative anatomy: | | |
| Mammals (skulls and skeletons) | 308 | |
| Birds | 236 | |
| Reptiles and batrachians | 29 | |
| | | 573 |
| Paleozoic fossils | | 1,229 |
| Mesozoic fossils | | 69 |
| Cenozoic fossils (included with mullusks), fossil plants | | 329 |
| Recent plants | | 1,195 |
| Minerals | | 9,411 |
| Lithology and physical geology.<br>Metallurgy and economic geology | | ‡3,600 |
| Total | | 81,992 |

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* Although about 200 specimens have been received during the year, the total number of specimens now in the collection is less than that estimated in 1888–'89, owing to the rejection of worthless material.

† Including the Catlin Gallery.

‡ Estimated on basis of receipts in previous years, the curator being unable to ascertain the growth of the collections under his care during the fiscal year 1889–'90. These two departments are now combined under the Department of Geology.

The following table shows the total number of specimens estimated in the various departments of the Museum at the end of June, 1890, and in previous years since 1882:

| Name of department. | 1882. | 1883. | 1884. | 1885-'86. (*a*) | 1886-'87. | 1887-'88. | 1888-'89. | 1889-'90 (*b*) |
|---|---|---|---|---|---|---|---|---|
| Arts and industries: | | | | | | | | |
| Materia medica | ........ | 4,000 | 4,442 | 4,850 | 5,516 | 5,762 | 5,912 | (*c*) 5,915 |
| Foods | ........ | 1,244 | 1,580 | 822 | 877 | 877 | 911 | 1,111 |
| Textiles | ........ | ........ | 2,000 | 3,063 | 3,144 | 3,144 | 3,222 | 3,288 |
| Fisheries | ........ | ........ | 5,000 | 9,870 | 10,078 | 10,078 | 10,078 | 10,080 |
| Animal products | ........ | ........ | 1,000 | 2,792 | 2,822 | 2,822 | 2,948 | 2,949 |
| Graphic arts | ........ | ........ | ........ | ........ | ........ | ........ | ........ | (*d*) 600 |
| Transportation and engineering | ........ | ........ | ........ | ........ | ........ | ........ | ........ | 1,250 |
| Naval architecture | ........ | ........ | 600 | ........ | ........ | ........ | 600 | (*e*) 600 |
| Historical relics | ........ | ........ | ........ | 1,002 | 13,634 | 14,640 | 14,990 | 20,890 |
| Coins, medals, paper-money, etc | ........ | ........ | ........ | 1,005 | | | | |
| Musical instruments | ........ | ........ | ........ | 400 | 417 | 427 | 427 | 447 |
| Paints and dyes | ........ | ........ | ........ | 2,278 | 2,238 | 3,011 | 3,011 | 3,132 |
| The Catlin Gallery | ........ | ........ | ........ | 77 | 100 | 100 | 109 | 197 |
| Physical apparatus | ........ | ........ | ........ | 500 | 500 | 500 | 500 | (*f*) |
| Oils and gums | ........ | ........ | ........ | 250 | 251 | 251 | 251 | 263 |
| Chemical products | ........ | ........ | ........ | 197<br>659 | 198<br>661 | 198<br>661 | 213<br>688 | 1,112 |
| Domestic animals | ........ | ........ | ........ | ........ | ........ | ........ | ........ | 66 |
| Ethnology | ........ | ........ | 200,000 | 500,000 | 503,764 | 505,464 | 506,324 | 508,830 |
| American aboriginal pottery | ........ | ........ | 12,000 | 25,000 | 26,022 | 27,122 | 28,222 | 29,269 |
| Oriental antiquities | ........ | ........ | ........ | ........ | ........ | ........ | 850 | 3,485 |
| Prehistoric anthropology | 35,512 | 40,491 | 45,252 | 65,314 | 101,659 | 108,631 | 116,472 | 123,677 |
| Mammals (skins and alcoholics) | 4,660 | 4,920 | 5,694 | 7,451 | 7,811 | 8,058 | 8,275 | 8,836 |
| Birds | 44,354 | 47,246 | 50,350 | 55,945 | 54,987 | 56,484 | 57,974 | 60,219 |
| Birds' eggs and nests | ........ | ........ | 40,072 | 44,163 | 48,173 | 50,055 | 50,173 | 51,241 |
| Reptiles and batrachians | ........ | ........ | 23,495 | 25,344 | 27,542 | 27,664 | 28,405 | 29,050 |
| Fishes | 50,000 | 65,000 | 68,000 | 75,000 | 100,000 | 101,350 | 107,350 | 122,575 |
| Vertebrate fossils | ........ | ........ | ........ | ........ | ........ | ........ | ........ | (*g*) 512 |
| Mollusks | 33,375 | ...... | 400,000 | 460,000 | 425,000 | 455,000 | 468,000 | 471,500 |
| Insects | 1,000 | ........ | 151,000 | 500,000 | 585,000 | 595,000 | 603,000 | 618,000 |
| Marine invertebrates | 11,781 | 14,825 | 200,000 | 350,000 | 450,000 | 515,000 | 515,300 | 520,000 |
| Comparative anatomy: | | | | | | | | |
| Osteology | 3,535 | 3,640 | 4,214 | 10,210 | 11,022 | 11,558 | 11,753 | 12,326 |
| Anatomy | 70 | 103 | 3,000 | | | | | |
| Paleozoic fossils | ...... | 20,000 | 73,000 | 80,482 | 84,491 | 84,649 | 91,126 | 92,355 |

*a* No census of collection taken.

*b* The actual increase in the collections during the year 1889-'90 is much greater than appears from a comparison of the totals for 1889 and for 1890. This is explained by the apparent absence of any increase in the Department of Lithology and Metallurgy, the total for 1890 in both of these departments combined showing a decrease of 46,314 specimens, owing to the rejection of worthless material.

*c* Although about 200 specimens have been received during the year, the total number of specimens in the collection is now less than that estimated for 1889, owing to the rejection of worthless material.

*d* The collection now contains between 3,000 and 4,000 specimens.

*e* No estimate of increase made in 1890.

*f* Included in the historical collection.

*g* Only a small portion of the collection represented by this number was received during the year 1889-'90.

| Name of department. | 1882. | 1883. | 1884. | 1881–'86. (a) | 1886–'87. | 1887–'88. | 1888–'89. | 1889–'90. (b) |
|---|---|---|---|---|---|---|---|---|
| Mesozoic fossils | | | 100,000 | 69,742 | 70,775 | 70,925 | 71,236 | 71,305 |
| Cenozoic fossils | (Included with mollusks.) | | | | | | | |
| Fossil plants | | 4,624 | 7,291 | (c) 7,492 | 8,462 | 10,000 | 10,178 | 10,507 |
| Recent plants | | | | 30,000 | 32,000 | 38,000 | 38,459 | (d) 39,654 |
| Minerals | | 14,550 | 16,610 | 18,401 | 18,601 | 21,896 | 27,690 | 37,101 |
| Lithology and physical geology | 9,075 | 12,500 | 18,000 | 20,647 | 21,500 | 22,500 | 27,000 | (e) 32,762 |
| Metallurgy and economic geology | | 30,000 | 40,000 | 48,000 | 49,000 | 51,412 | 52,076 | |
| Living animals | | | | | | 220 | (f) 491 | |
| Total | 193,362 | 263,143 | 1,472,600 | 2,420,944 | 2,666,335 | 2,803,459 | 2,864,244 | 2,895,104 |

*a* No census of collection taken.

*b* The actual increase in the collections during the year 1889–'90 is much greater than appears from a comparison of the totals for 1889 and for 1890. This is explained by the apparent absence of any increase in the Department of Lithology and Metallurgy, the total for 1890 in both of these departments combined showing a decrease of 46,314 specimens, owing to the rejection of worthless material.

*c* Only a small portion of the collection represented by this number was received during the year 1889–'90.

*d* This relates only to specimens received through the Museum, and does not include material added to the National Herbarium, through the Department of Agriculture.

*e* Collections combined in October, 1889, under the Department of Geology. The apparent decrease of more than 50 per cent. of the estimated total for 1889 is accounted for (1) by the rejection of several thousands of specimens from the collection, and (2) by the fact that no estimate of the ones in the reserve and duplicate series is included. Of the total number for 1890 about 16,000 specimens consist chiefly of petrographical material, stored away for study and comparison in the drawers of table cases.

*f* Transferred to National Zoölogical Park.

## CATALOGUE ENTRIES DURING THE YEAR ENDING JUNE 30, 1890.

The catalogue entries made in the books of the several departments during the year amounted to 28,293 in number. The following table shows the number of entries made in each department. It must be remembered that a catalogue entry seldom refers to only one specimen. Thus if fifty specimens of birds are contributed by one person, from one locality, they are entered under a single catalogue number. In the case of the Department of Marine Invertebrates, one entry often includes several hundred specimens.

| Number and name of department. | No. of entries during 1889-90. | Number and name of department. | No. of entries during 1889-90. |
|---|---|---|---|
| I. Arts and industries: | | VI. Reptiles and batrachians | 705 |
| Materia medica | 179 | VII. Fishes | 1,016 |
| Textiles | 38 | VIII. Vertebrate fossils | 124 |
| Foods | 68 | IX. Mollusks (including Cenozoic fossils) | 6,569 |
| Animal products | 1 | X. Insects | 89 |
| Paints and dyes | 11 | XI. Marine invertebrates | 1,502 |
| Fisheries | 2 | XII. Comparative anatomy: | |
| Transportation and engineering | 750 | Mammals | 340 |
| Chemical products | 42 | Birds | 235 |
| Modern pottery, porcelain, and bronzes | 5 | Reptiles and batrachians | 29 |
| Musical instruments | 20 | XIII. Invertebrate fossils: | |
| Coins, medals, paper-money, etc. | 620 | Paleozoic | 5,412 |
| Graphic arts | 577 | Mesozoic | *500 |
| Domestic animals (for mounting) | 61 | XIV. Fossil plants | 200 |
| II. Ethnology | 1,469 | XV. Recent plants | 24 |
| III. Oriental antiquities | 1,471 | XVI. Minerals | 588 |
| IV. Mammals | 573 | XVII. Lithology and physical geology | 2,268 |
| V. Birds | 1,739 | XVIII. Metallurgy and economic geology | 504 |
| (*b*) Birds' eggs | 239 | Total | 28,293 |

* Not actually recorded, although the material to be catalogued will fill up five hundred numbers.

## DEVELOPMENT AND ARRANGEMENT OF THE EXHIBITION SERIES.

Owing to the already crowded condition of the exhibition halls, there has been no opportunity of increasing very materially the exhibition series in the several departments.

A large number of specimens of foods and textiles have been mounted in bottles and boxes, ready to be placed on exhibition when space and cases are available. The collection of Paleozoic invertebrate fossils has been labeled. The fossils from the Cincinnati formation of Ohio have been rearranged by Prof. Joseph F. James. The crustaceans from the Water-lime formation of New York, and from the Chazy horizon of New York and Vermont, have been relabeled, and, with much additional material, placed on exhibition. A beautiful series of trilobites has been placed temporarily in the exhibition cases, awaiting permanent transfer from the U. S. Geological Survey to the Museum. The Mesozoic fossils have been classified and arranged for exhibition. Three groups of mammals have been installed during the year, and a considerable number of single specimens added to the exhibition series. Although the number of specimens added to the collection of birds is considerably less than in the previous year, the appearance of the exhibition series has been greatly improved by the substitution of new cases for the old ones, and by the rearrangement and relabeling of the collection. A large collection of illustrations of North American insects, prepared for the Paris Exposition, has been placed on exhibition. Lay figures representing a Papuan, a Dyak and a Samoan, in native dress, have been placed in the ethnological hall.

Technical and historical series of specimens have been placed on exhibition in the section of graphic arts. The details of this arrangement have been set forth in a circular intended for the guidance of visitors, and printed in the report of the curator. A commencement has been made of an exhibit of forestry objects. A large number of labels have been added to the exhibition series of fishes, and the groups have been brought more closely together. The material in the collection of tertiary fossils has been segregated according to its biologic relations, and its incorporation with the general collections. The collection of minerals has been rearranged, and a new installation of the gem series is under way. The collection of North American lizards has been installed in new quarters. Much time has been devoted by Dr. James M. Flint to the arrangement of specimens of materia medica already on hand. The Aino material collected by Mr. Romyn Hitchcock has been fully labeled and installed. The economic collection of insects, which was somewhat damaged during the return shipment from the Paris Exposition, has been overhauled and put in place again. The Hemiptera Heteroptera have been rearranged according to Uhler's check-list. The ores and general economic material in the exhibition hall have been arranged into two principal series; the one, comprising a systematic exhibit of all the principal ores of the metals arranged; the other, arranged geographically by States. Mr. Lucas has devoted a portion of his time to the identification and arrangement of skeletons of birds and tortoises. The classification of the star-fishes, collected by the U. S. Fish Commission steamer *Albatross* in the North Pacific Ocean, has been continued.

## E.—THE MUSEUM STAFF.

### THE SCIENTIFIC STAFF.

During the year, the departments of "Lithology and Physical Geology" and "Metallurgy and Economic Geology" have been united under the designation of the Department of Geology. Since the organization of the departments in the National Museum in 1881, these departments have until now been kept entirely distinct, and each department has been under the control of a curator. It has been thought for some time, however, that it would be advantageous to the administration of the Museum to combine the work of these closely allied departments, and this was finally carried into effect on October 1, 1889, upon the resignation of Mr. F. P. Dewey. Mr. George P. Merrill is now in charge of the Department of Geology.

Mr. Romyn Hitchcock, who on July 31, 1886, was furloughed to enable him to visit Japan as an instructor in the University of Tokio, returned January 20, 1889, and has again resumed his duties as curator of the collection of Foods and Textiles.

The Smithsonian collection of scientific instruments, which some years ago was transferred to the custody of the National Museum, has received some additions during the year, and has been placed under the charge of Mr. W. C. Winlock, curator of the Bureau of International Exchanges of the Smithsonian Institution.

In June, 1890, Dr. Frank Baker, Assistant Superintendent of the U. S. Life Saving Service, resigned his position to accept an appointment as curator of Comparative Anatomy in the National Museum. This department has for many years been administered upon by Mr. F. W. True as acting curator. Dr. Baker will not, however, at present assume the duties of this position, having received from the Secretary of the Smithsonian Institution a temporary appointment as acting manager of the National Zoölogical Park.

Mr. William T. Hornaday, for several years chief taxidermist, was on May 9, 1888, appointed curator of the Department of Living Animals. On May 6, 1889, he was placed in charge of the National Zöological Park; and on June 15, 1889, resigned this position. The collection of living animals hitherto under the care of the Museum has now been transferred to the custody of Dr. Frank Baker, as acting manager of the Zoölogical Park.

At the request of Prof. C. V. Riley, Mr. John B. Smith, formerly assistant curator of Insects in the National Museum, was engaged from January 3 to February 3, 1890, to work upon the collection of *Noctuidæ.*

Mr. William Harvey Brown, of the National Museum, accompanied the Government "Eclipse Expedition" to Africa for the purpose of collecting natural history specimens for the Museum. The expedition sailed in October, 1889, on the U. S. S. *Pensacola*. A reference to Mr. Brown's explorations will be found in the chapter devoted to that subject.

On account of the increasing administrative duties which have been placed upon Mr. Richard Rathbun, of the U. S. Fish Commission, it has been found impossible to keep up the current work in the Department of Marine Invertebrates. It therefore seemed desirable to appoint an assistant, paid by the Museum, who could devote his entire time, under the supervision of Mr. Rathbun, to the work of the department. Mr. James E. Benedict, formerly naturalist of the Fish Commission, who had severed his connection with the Commission in 1886, accepted an appointment on January 13, 1890, as assistant curator of the Department of Marine Invertebrates.

At the request of Dr. C. A. White, the director of the U. S. Geological Survey appointed Mr. T. W. Stanton to assist Dr. White in the work of the Department of Mesozoic Invertebrate Fossils in the Museum.

There are now thirty-one organized departments and sections in the Museum under the care of curators, including honorary and acting curators, and assistant curators.

### LIST OF CURATORS, ASSISTANT CURATORS, AND AIDS.

ARTS AND INDUSTRIES: Dr. G. Brown Goode, Honorary Curator.
  MATERIA MEDICA: Dr. James M. Flint, U. S. Navy, Honorary Curator.
  TEXTILES: Mr. Romyn Hitchcock, Acting Curator.
  ANIMAL PRODUCTS: Mr. R. Edward Earll, Acting Curator.
  NAVAL ARCHITECTURE: Capt. J. W. Collins, U. S. Fish Commission, Honorary Curator.
  FOODS: Prof. W. O. Atwater, Department of Agriculture, Honorary Curator.
  HISTORICAL COLLECTIONS, COINS AND MEDALS: Mr. A. Howard Clark, Curator.
  TRANSPORTATION AND ENGINEERING: Mr. J. E. Watkins, Curator.
  ORIENTAL ANTIQUITIES: Prof. Paul Haupt, Johns Hopkins University, Honorary Curator; Dr. Cyrus Adler, Johns Hopkins University, Assistant Curator.
  GRAPHIC ARTS: Mr. S. R. Koehler, Boston Museum of Fine Arts, Acting Curator.
  FORESTRY: Dr. B. E. Fernow, Department of Agriculture, Honorary Curator.
  PHYSICAL APPARATUS: Prof. W. C. Winlock, Honorary Curator.
ETHNOLOGY: Prof. Otis T. Mason, Curator; Mr. Walter Hough, Assistant.
AMERICAN PREHISTORIC POTTERY: Mr. William H. Holmes, Bureau of Ethnology, Honorary Curator.
PREHISTORIC ANTHROPOLOGY: Dr. Thomas Wilson, Curator; Mr. E. P. Upham, Assistant.
MAMMALS: Mr. Frederick W. True, Curator.
BIRDS: Mr. Robert Ridgway, Curator.
BIRDS' EGGS: Capt. C. E. Bendire, U. S. Army, Honorary Curator.
REPTILES AND BATRACHIANS: Dr. Leonard Stejneger, Curator.
FISHES: Dr. Tarleton H. Bean, U. S. Fish Commission, Honorary Curator; Mr. Barton A. Bean, Assistant.
VERTEBRATE FOSSILS: Prof. O. C. Marsh, Yale College, Honorary Curator.
MOLLUSKS: Mr. William H. Dall, U. S. Geological Survey, Honorary Curator; Dr. R. E. C. Stearns, Adjunct Curator.
INSECTS: Prof. C. V. Riley, Department of Agriculture, Honorary Curator; Mr. Martin L. Linell, Aid.

**MARINE INVERTEBRATES**: Mr. Richard Rathbun, U. S. Fish Commission, Honorary Curator; Mr. James E. Benedict, Assistant Curator.

**COMPARATIVE ANATOMY**: Dr. Frank Baker, Curator; Mr. Frederick A. Lucas, Assistant Curator.

**INVERTEBRATE FOSSILS**:

**PALEOZOIC**: Mr. C. D. Walcott, U. S. Geological Survey, Honorary Curator.

**MESOZOIC**: Dr. C. A. White, U. S. Geological Survey, Honorary Curator.

**CENOZOIC**: Prof. William H. Dall, U. S. Geological Survey, Honorary Curator.

**FOSSIL PLANTS**: Prof. Lester F. Ward, U. S. Geological Survey, Honorary Curator; Mr. F. H. Knowlton, Honorary Assistant Curator.

**BOTANY**: Dr. George Vasey, Department of Agriculture, Honorary Curator.

**MINERALS**: Prof. F. W. Clarke, U. S. Geological Survey, Honorary Curator; Mr. William S. Yeates, Assistant Curator.

**GEOLOGY**: Mr. George P. Merrill, Curator.

## THE ADMINISTRATIVE STAFF.

No changes of importance have been made during the year. Mr. R. E. Earll has been engaged, since March, 1889, on special duty in the office of the Assistant Secretary.

The Department of Furniture, Supplies, and Accounts continues under the charge of Mr. W. V. Cox, chief clerk of the National Museum. A statement of the work accomplished will be found on page 62.

The Department of Correspondence and Reports is under the charge of Mr. R. I. Geare. A statement of the work accomplished during the year will be found on page 68.

The Department of Registration and Storage is under the charge of Mr. S. C. Brown, and a report of his work will be found on page 43.

Mr. A. Howard Clark has continued his work as editor of Proceedings and Bulletins of the National Museum. The preparation and printing of labels for Museum specimens has, as in past years, also been under his supervision.

The Museum library, which is made up, for the most part, of that portion of the library of the Smithsonian Institution which is required for reference by the curators of the scientific departments in the Museum, is under the care of Mr. John Murdoch, librarian of the Smithsonian Institution. A statement relating to the operations of the library during the year will be found on page 48.

Mr. Henry Horan, superintendent of buildings, with Mr. Charles A. Steuart as assistant superintendent, has continued in charge of the work of the mechanics and laborers of the Museum. On page 71 will be found a statement of the work accomplished by the force of mechanics and laborers.

## F.—REVIEW OF WORK IN THE SCIENTIFIC DEPARTMENTS.

### DIVISION OF ANTHROPOLOGY.

*Department of Ethnology.*—The first three months of the year covered by this report were spent by Prof. Otis T. Mason, curator, in studying the anthropological collections in Europe, especially those at the Paris Exposition, during the session of the Tenth International Congress of Anthropology and Prehistoric Archæology, an account of which is submitted in his annual report.

The curator is giving much attention to three special lines of research and collection in connection with the work of his department; first, among the Indian tribes of our own country; second, among the South American tribes; third, among the African tribes of the west coast, especially those whose descendants made up the former slave population of the United States, for the purpose of comparison with the effects which civilization has had upon the race in this country.

Following up the work of former years, much time has been devoted to the study of the bow, the arrow, the quiver and armor.

Mr. Walter Hough is making a thorough study of the production of fire by primitive peoples, and has published in the Museum report for 1888 an exhaustive paper on fire-making apparatus, as represented in the collections of the U. S. National Museum.

Among the most important accessions is the collection of Japanese and Aino material gathered by Mr. Romyn Hitchcock. This material has been labeled and installed in the Museum. The collection of African material has been enriched by the addition of objects from the Inhambane Zulus, collected by the missionary, Rev. E. H. Richards, and presented by Oberlin College. Mr. W. H. Brown, naturalist of the United States Eclipse Expedition, secured material from Angola, and Mr. J. H. Camp contributed objects from the Congo.

Several valuable collections of Samoan material have been received through Admiral Kimberly, U. S. Navy, and from Ensign W. E. Safford. Mrs. H. A. P. Carter has given photographs and specimens from the Sandwich Islands. Dr. H. N. Allen, court physician to the King of Corea, has deposited in the Museum his rich collection from that kingdom. Dr. Washington Matthews's collection of Navajo silver-work has been acquired; also specimens of old Indian work of great value from Rev. E. C. Chirouse through the Department of the Interior; specimens from Idaho and Washington from Dr. George M. Kober, U. S. Army, and collections from the Hupa Valley, California, made by N. J. Purcell and Jeremiah Curtin.

*Department of American Prehistoric Pottery.*—The installation of the exhibition series of pottery is now almost completed, and very little remains to be done excepting in connection with the labeling of specimens. Mr. William H. Holmes has continued to act as honorary curator of this department. The principal additions to the collections have been secured through the coöperation of the Bureau of Ethnology, with which Mr. Holmes is officially associated. One of the most interesting is a group of vases from a mound on the Savannah River, obtained by Mr. H. L. Reynolds. In connection with the monograph which Dr. Cyrus Thomas, of the Bureau of Ethnology, has undertaken upon the Mound-builders, the curator has conducted researches upon the collections from the mounds of the Mississippi Valley and adjacent regions. The number of specimens added to the collection during the year is estimated at 1,047, and 232 entries have been made in the catalogue.

*Section of Oriental Antiquities.*—The collection is under the curatorship of Prof. Paul Haupt, of the Johns Hopkins University, with Dr. Cyrus Adler acting as assistant curator.

Many valuable accessions have been received during the year. Among these is a cast of the famous temple inscription discovered by Clermont-Ganneau in 1871, which was obtained through the courtesy of the United States minister to Turkey. Mr. Theodore Graf, of Vienna, and Dr. Zehnpfund, of Leipsic, have also made important contributions. A collection of copies of the Assyrian seals has been commenced, and much assistance has been rendered by Dr. William Hayes Ward, of New York, Prof. D. G. Lyon, of Harvard University, and Prof. H. Hyvernat, of the Catholic University in Washington. A collection of oriental manuscripts, formed by Mr. William B. Hodgson, and until recently in the care of the Telfair Academy of Arts and Sciences of Savannah (Georgia), has been placed in the custody of the Smithsonian Institution.

The curator attended the Eighth International Congress of Orientalists, which met at Stockholm in September, as the representative of the Smithsonian Institution.

There has been added a case of objects illustrating the public and private religious ceremonies of the Jews, collected and arranged by Dr. Adler. These objects were obtained partly through purchase, but chiefly through gift and deposit. Some of the more interesting were collected by Dr. H. Friedenwald.

Dr. Adler thus explains the character of the collection:

> The collection may be divided into two sections comprising the objects employed respectively in public and private ceremonial.
>
> The Pentateuch or Law (Hebrew *Torah*) is considered by Jews the most important part of the Bible, and a section of it is read every week in the synagogue. For this purpose a manuscript-copy is employed, printed copies not being used. When not in use the roll is covered with a cloak and placed upright in an ark or chest; to prevent the reader from losing his place, a pointer in the shape of a hand (called in Hebrew *Yad* or "hand") is employed. The collection contains a manuscript pentateuch unrolled with the pointer, and above it the cloak and winding-scarf which envelop it when placed in the ark.
>
> At the morning service in the synagogue the male members of the congregation wear a special garment, a sort of scarf, known as the

*Taleth.* This garment is a survival of the outer robe of the ancient Hebrews. They wear on the corners a fringe or tassel in which is a thread of blue. A garment of the form now used is referred to in the New Testament (Matthew IX, 20; XIV, 36; Luke VIII, 44). They are made of silk, woolen, and even of cotton goods. The grave clothes of a male Israelite consist of a shroud and the *taleth.* The specimen in the collection is made of silk.

These objects are used at the Saturday morning service, and the *taleth* at the daily morning service where this survives. It is also worn at the afternoon service on Sabbath and fasts, and at the evening service of Sabbaths and festivals by the officiating minister only.

In addition to the *taleth,* the male members of the congregation wear at the morning service of week days, phylacteries, and where daily synagogue service is not held, they are employed in private devotion. Certain passages of the Pentateuch (Exodus XIII, 9, 10, 16; 1 Deuteronomy VI, 4, 9, 13, 22) enjoin that the law should be a sign upon the hand and for frontlets between the eyes. These passages, inscribed upon several pieces of parchment and inclosed in a leather case prepared for the purpose, are bound on the forehead between the eyes. The same passages written on one slip of parchment and inclosed in a similar case are bound on the left arm above the elbow. They are called by the Jews tefillin (from tefilla, "prayer"), a word found in the Talmud, but not in the Bible. They are referred to in the New Testament (Matthew XXIII, 5). The collection contains several sets of phylacteries of various sizes.

Special services call for the use of particular objects of ceremony.

At the conclusion of the Sabbath there are added some special prayers, and the service known as *Habdalah,* or separation. The objects used in this service are a cup of wine, a spice-box, and a candle. First, blessing is said over the wine, next over the spices, and last over the light. The candle is then extinguished by having wine poured upon it. The collections contain a specimen of a silver spice-box, supposed to have been manufactured in Laupheim (Würtemberg), Germany, about 1740. There is a tradition that at the beginning of the Sabbath a special angel accompanies the worshiper from the synagogue; this angel remains with him until the conclusion of the Sabbath. The departure of the angel leaves the man faint, and the spices are intended to restore him.

The second great Jewish feast is the feast of weeks, also called "feast of harvest" and day of first fruits. The harvest referred to is the grain harvest. Deuteronomy XVI, 9, commands: "Seven weeks shalt thou number unto thee," beginning the day after Passover, when the first Omer was presented. The fiftieth day (Pentecost) was observed as a sacred feast. Since mediæval times the Jews also celebrate it as the anniversary of the delivery of the law on Mount Sinai. Following Leviticus XXIII, 2, the Samaritans observed Pentecost on Sunday. The Hebrew word meaning a handful of grain, a sheaf, is *Omer,* and the period between Passover and Pentecost is known as the Omer season. The days of this season are reckoned and the number announced each day. For the purpose of keeping the reckoning, a tablet is hung up in the synagogue. The collection contains a manuscript copy of such a tablet which was employed by a Spanish-Jewish congregation. The tablet is in Hebrew. It contains the words "Blessed art thou Lord, our God, King of the Universe, who has sanctified us with His commandments and commanded us to count the Omer." Then follows the count (in Hebrew) and below it the words "May the Lord restore the worship of the temple speedily in our days" (Psalm LXVII). On the left are the letters H. S. and D., which indicate respectively Omer (written Homer by the Spanish Jews) week (Sabbat) and day.

In the Jewish ceremonial on solemn occasions, and especially on New Year's day (September), a blast is sounded from a trumpet called *Shofar.* It is made of a ram's horn whose shape is modified by heat. According to authorities on musical instruments, it is the oldest form of wind-instrument known to be retained in use. It is mentioned in the Bible as being used to announce the new moon and solemn feasts and to proclaim the year of release. Occasionally it was employed as a musical instrument, but its most frequent use was for military purposes. It was the signal for going out to battle, for the announcement of a victory, and for the recall of the troops. The specimen in the collection is an example of the seventeenth century, from Italy.

The feast of Purim was established to commemorate the deliverence of the Jews, recorded in the book of Esther. On this occasion the book is read in the synagogue, a manuscript copy being employed. The collection contains a manuscript roll of the Hebrew original, with hand-painted views. The book is usually called *Megilla* (roll), or more accurately *Megillat* Esther (roll of Esther). The Song of Solomon, Ruth, Ecclesiastes, and Lamentations are written in a similar form, and they together with Esther are called "the five rolls."

The feast of dedication, or *Hanuka,* is held in remembrance of the rededication of the Temple of Jerusalem after its defilement by Antiochus Epiphanes (169 B. C.). Josephus records that it was a festival of lights. The feast is celebrated 8 days, one light being lit on the first night of the feast, and an additional light on each succeeding night. The collection contains a lamp of brass, hand made, with eight compartments for oil. The lamp is of Dutch make, and its form exhibits an interesting survival of the ancient Roman lamp.

The specimens described are employed at public worship, though some of them may be used at private devotion. Any place in which ten male Israelites congregate is considered a place of public worship.

The following objects pertain exclusively to private worship:

The Mosaic legislation enjoined that the law should be written on the posts of the door and on the gates. This injunction is performed by inclosing a slip of parchment in a reed, or metallic or wooden cylinder, on which has been written Deuteronomy VI, 4–9, 13–21, and attaching it to the doorpost of the house, and sometimes of each room in the house. At present the Jews of the East often nail to the door-casing the entire decalogue inclosed in a tin case called *Mezuzza.* This custom has been widely adopted by other peoples of the East, particularly by Mussulmans, who select for this purpose passages from the Koran.

Whether at public or private devotion, the Jews invariably turn the face toward Jerusalem. For the large majority of Jews this direction is east. Synagogues are always built with the ark containing the manuscript copies of the Pentateuch at the eastern end of the building, and worshippers face this direction. As a reminder of the direction a card or scroll is hung up in the dwelling called *Mizrach* (the east). The specimen in the collection contains the Ten Commandments and various quotations from scripture in Hebrew. Ancient nations that worshipped the sun, turned when in prayer to the east, the place of the rising sun. This fact is alluded to by Ezekiel (VIII, 16). In the temple itself the worshippers faced towards the west, the entrance being from the east.

Before the principal meals of the Sabbath day the Jews have a special service, including prayers over the bread and wine, which is known as *Kiddush* or "sanctification." The head of the family has in front of him a plate containing two loaves of bread, covered by a cloth, of which there is a specimen in the collection. This cloth, called *Kiddush* cloth, contains the prayers to be recited, and representations of the Temple, etc., evidently after old wood cuts. The practice of saying a blessing before eating is referred to, I Samuel IX, 13. It no doubt had its origin in the fact that a public meal of any sort was usually preceded by a sacrifice. "Asking the blessing" was common in New Testament times. The later Jews enjoined also that thanks should be returned after the repast.

At the meal of the Passover eve (probably the same as the "Lord's Supper") special plates were used on which to place cakes of unleavened bread. The collection contains two such, one made of brass containing fantastic figures and a Hebrew inscription, from Constantinople; the other of pewter, manufactured at Tetenhausen (near Gusburg) in Germany.

It was customary among the Jews to reserve a special lamp for use on the eve of the Sabbath only. Oil was burned in these from either six or eight prongs. Seven prongs were never used, because this lamp was not to be of the same shape as the seven-pronged candlestick of the sanctuary. The collection contains two specimens of the form used by the Jews of Germany, one having been manufactured in the eighteenth century at Fellheim, Germany.

The collection also contains a map of Palestine and surrounding countries, with the names of places marked in Hebrew characters, a chromo-lithographic restoration of the Tabernacle, a series of photographs of the ruins of ancient synagogues, of the Arch of Titus, and of the exteriors and interiors of the celebrated synagogues of Europe.

*Section of Foods and Textiles.*—Upon the return of Mr. Romyn Hitchcock, from Japan, he reassumed the custody of the collections of Food and Textiles. A greater portion of the year has been consumed in the examination and classification of the material which had accumulated during his absence. He has prepared an index to the collection, showing the series to which each specimen has been assigned, and also a list of the specimens in the exhibition series. The labeling of the collection of foods of the North American Indians has been completed. The labeling of the collection of textiles has also for the most part been furnished. Mr. Hitchcock, in addition to his regular work, has prepared two papers embodying the results of his observations in Japan during 1887 and 1888. These are entitled "The Ancient Pit-dwellers of Yezo," and "The Ainos of Yezo." Both of these papers are published in this report.

The number of specimens of textiles in the exhibition, reserve, and duplicate series is 2,211; 38 catalogue entries have been made. The number of specimens in the food collection on exhibition, and also in the reserve and duplicate series is 1,111; 68 entries have been made in the catalogue. In this total the specimens collected by Mr. Hitchcock, from the Ainos of Japan, are not included.

In the chemical collection, also under Mr. Hitchcock's care, there are now 457 specimens on exhibition, and 852 specimens in the reserve and duplicate series. There have been made 42 entries in the catalogue devoted to chemicals, including oils, gums, and resins.

*Department of Prehistoric Anthropology.*—The curator, Mr. Thomas Wilson, visited the Paris Exposition, as the representative of the Smithsonian Institution, for the special purpose of attending the International Congresses of Hygiene, Criminal Anthropology, Anthropology, and Prehistoric Archæology, and the French Association for the Advancement of Science. An account of his visit is given in his annual report in section II.

The most important accession during the year is the collection of archæological specimens, principally from the District of Columbia, presented by Mrs. J. C. Bruff, of Washington, District of Columbia. Contributions were also received from Mr. Thomas Wilson, the curator, Mr. H. de Morgan, New York City; Mr. J. P. Monroe, Ringgold, Tennessee; Messrs. Bangs & Company, New York City; Mr. S. V. Proudfit, Falls Church, Virginia; The Peabody Museum, Cambridge, Massachusetts (through Prof. F. W. Putnam); Dr. Hilborn T. Cresson, Philadelphia, Pennsylvania; and Mr. L. H. Jammes, Realmont, France.

The collections have been divided into an exhibition and a study series. A classification of the stone arrow, or spear-heads, and of the knives has been commenced.

In the catalogue 1,483 entries have been made during the year. The entire collection contains 122,679 specimens.

*Section of Transportation and Engineering.*—Other duties of the curator, Mr. J. E. Watkins, as engineer of property, have prevented him from devoting much time to the development of this collection. Considerable progress has, however, been made both in the arrangement and labeling of the specimens. The system of classification has been set forth in a previous report of the curator.

The accessions during the year though less numerous than in the previous year are equal in importance.

To the series illustrating the history of the stationary steam engine, a portion of the cylinder of the first steam engine erected on the western continent has been added.

Interesting specimens relating to the early history of the telegraph have been received.

Two drawings made by Fulton, one of the *Chancellor Livingston*, and the other of the machinery of the *Catherine of Clermont*, have been added to the steamboat series.

The original boiler of the locomotive *Stourbridge Lion*, has been added to the series illustrating the history of the development of the locomotive. It is the intention of Mr. Watkins to mount the boiler on the original driving-wheels, and to replace many of the original parts which are still in existence, and thus as far as possible complete the restoration of this locomotive.

The nucleus of a collection illustrative of the history of the development of the bicycle, has been secured. A model of the English "Dandy

Horse" has been made in the Museum workshops, and two old-fashioned velocipedes with wooden wheels have been acquired. A number of drawings of parts of bicycles have also been secured.

The study series has been increased by a number of photographs and prints.

The preparation of a card catalogue of the collection has been commenced. The collection now contains approximately 1,250 specimens. Seven hundred and fifty entries have been made during the year in the catalogue.

*Section of Materia Medica.*—The collection of materia medica specimens is still under the charge of Dr. James M. Flint, U. S. Navy, by whom the collection was first organized in 1881. He reports that much time has been devoted to the identification and arrangement of specimens already on hand, and to the classification and installation of new material. The most important contribution to the collection are a collection of East India drugs, from the Royal Botanical Gardens, at Kew, England, and the collection of medicinal substances contributed by Messrs. W. H. Schieffelin & Co, of New York. The preparation of descriptive labels has been pushed rapidly forward, and the labeling of the collection is now almost completed, as well as the completion of a card catalogue of the collection, by means of which the present position of every specimen may be readily ascertained. The present state of the collection is highly satisfactory. There are now 3,213 specimens of drugs on exhibition. The reserve series contains 1,203 specimens. The total number of specimens in the collection, including the illustrations, is 5,915. The number of catalogue entries during the year is 179.

*Section of Graphic Arts.*—The arrangement of the collection in this Department has been for the time completed. The manuscript for the labels, which has been prepared for some time, is still in the printer's hands. A circular has been printed explaining the arrangement of the collection.

The most important accession during the year is the collection of materials, prints, and tools illustrative of the process of chromoxylography in Japan, given to the Museum by Mr. T. Tokuno, chief of the Japanese Government Printing Office at Tokio.

A series of drawings made by pupils of the Art Academy of Cincinnati, and presented by the Cincinnati Museum Association has been placed on exhibition.

During the year accessions were received from forty-seven sources, and nine additions were made by purchase to the sectional library. The number of entries made in the catalogue during the year was 577.

## DIVISION OF ZOÖLOGY.

*Department of Mammals.*—The accessions to this Department during the year are regarded by Mr. F. W. True, curator, as being of more than ordinary interest. The collections received from Dr. W. L. Abbott, and those obtained by the naturalists who accompanied the United States Eclipse Expedition to South Africa, are of special interest.

Three new groups of mounted animals have been placed on exhibition during the year, and thirty-three single specimens have been mounted and placed on exhibition.

Five hundred and sixty-one specimens have been added to the collection during the year, in addition to a large amount of material deposited by the Department of Agriculture.

*Department of Birds.*—The exhibition series in this Department has been very greatly improved during the year. The extensive collections made by the U. S. Fish Commission on the Galapagos Islands, and in other parts of tropical America, have been worked up by the curator, and the results have been published in Vol. XII of the Proceedings of the National Museum. A collection of birds from Costa Rica has been described in Vol. XI of the Proceedings of the National Museum. A careful revision has been made of the genera *Xiphocolaptes* and *Sclerurus*, and published in Vol. XII of the Proceedings of the National Museum. Dr. Leonhard Stejneger has continued his studies on the birds of Japan and the Hawaiian Islands, and has prepared a paper on the extinct Pallas' Cormorant of Bering Island.

The number of specimens in the reserve, duplicate, and exhibition series is now estimated by Mr. Ridgway to be 60,219, giving an increase of 2,245 specimens during the year. The number of catalogue entries made during the year is 1,739.

*Department of Birds' Eggs.*—The collection of birds' eggs remains in the custody of Capt. Charles E. Bendire, U. S. Army.

Among the accessions received during the year, fifteen are mentioned by Captain Bendire in his annual report as being of special importance. Among the most valuable is a collection of nests and eggs made near Fort St. James and presented by Mr. Robert MacFarlane, of the Hudson's Bay Company, also a collection of nests and eggs from Colorado, presented by Mr. Denis Gale. Several species, new to the collections, have been received during the year, including some nests of rare birds. The number of eggs of North American birds is now 44,326, and of foreign birds 4,424. The number of nests in the reserve and exhibition series is 2,491, making a grand total of 51,241 specimens of eggs and nests in the collection. This gives an increase of 1,068 over the total of last year.

*Department of Reptiles and Batrachians.*—Dr. Leonhard Stejneger, recently appointed curator of this Department, has commenced a rearrangement of the collections. The collection of North American lizards has been reclassified and catalogued. The most important accession of the year is a large series of reptiles and batrachians collected by Dr. C. Hart Merriam in the San Francisco mountain plateau in Arizona. Collections made by the U. S. Fish Commission steamer *Albatross*, and by Prof. David S. Jordan, president of the Indiana State

University, contain much new material. The curator made a valuable collection of reptiles, birds, and mammals in Arizona, New Mexico, and Texas, during the months of September, October, and November.

The curator has made a special study of the geographical distribution of the reptiles and batrachians of the southwestern Territories of the United States. He has also published in the Proceedings of the National Museum a number of papers describing new species.

The total estimated number of specimens in the Department is now 29,050. During the year 705 catalogue entries have been made.

*Department of Fishes.*—In the early part of the year the honorary curator, Dr. Tarleton H. Bean, was in Alaska for the purpose of investigating the condition of the fisheries, in connection with his official duties as ichthyologist of the U. S. Fish Commission. During his absence the routine work of the Department was carried on by Mr. Barton A. Bean, assistant.

The number of accessions received during the year is 38. Prominent among them are a collection of fishes from Switzerland; a large collection of fishes from Galapagos Islands, Panama, British Columbia, Alaska, and other regions in the Pacific Ocean, gathered by the naturalists of the U. S. Fish Commission steamer *Albatross;* a collection of American Siluroids, from the Museum of Comparative Zoölogy at Cambridge, Massachusetts; a series of fishes collected in the Yellowstone Park, by Dr. David S. Jordan and his assistants, transmitted by the U. S. Fish Commission. The Fish Commission has also deposited in the Museum an extensive collection of fishes made by Dr. Jordan in several of the southern and western States and Territories, during the summer of 1889.

In the catalogue of the Department 1,016 entries have been made. The estimated number of specimens in the exhibition, reserve and duplicate series, is now about 122,000.

*Department of Mollusks* (including tertiary fossils).—Mr. William H. Dall, of the U. S. Geological Survey, has continued to take charge of this department. He has been assisted in the scientific work of the Department by Dr. R. E. C. Stearns, as adjunct curator, and by Mr. Frank Burns and Mr. Gilbert Harris, of the Geological Survey, by whom several important results have been accomplished. Considerable progress has been made in the determination, assorting, and labeling of material. Special reports upon collections received from the Fish Commission, the Navy Department, the Department of Agriculture, the Revenue Marine Service, and other sources have been made. A preliminary report upon the collections of the *Albatross* has been completed, and a report upon the collections made by the Eclipse Expedition to Africa is in course of preparation.

Mr. Dall has partially completed a report upon the Plio-Miocene mollusk fauna of Florida, the first part of which is now being printed by the Wagner Free Institute of Science, in Philadelphia.

The total number of accessions received during the year is given in Mr. Dall's report as 87. The total number of specimens received is estimated at 3,500, representing about 1,200 species. Valuable collections have been contributed by Mr. Henry Hemphill, from Lower California. Important additions to the fauna of Florida have been received from Messrs. G. W. Webster, J. J. White, and I. Greegor; and collections of West Florida shells have been presented by Mr. W. F. DeGolier. The Geological Survey has transferred to the Museum a valuable collection of Post-Pliocene types, illustrating the paper of Mr. R. E. Call in regard to the fresh-water fossils of Bonneville Lake Basin, Utah. A series of the smaller species of land shells has been presented by Dr. Sterki. Mr. W. G. Binney has contributed several additions to the Binney collection of American land-shells. A series of slides of sections of typical mollusks has been received from Dr. P. H. Carpenter, of Eton College, England.

Mr. Dall reports that about 75,000 specimens are now ready for systematic arrangement in the new cases which have been provided for this Department.

*Department of Insects.*—Prof. C. V. Riley, entomologist of the Department of Agriculture, continues in charge of the Department of Insects. The laboratory space of this department has been enlarged. The educational series in the exhibition hall has been improved. A large number of illustrations of North American insects, prepared by Professor Riley for exhibition at the Paris Exposition, have been added to the exhibition series

Several important accessions have been received during the year. Lord Walsingham has presented 125 species of rare Micro-Lepidoptera. Mr. A. Koebele has placed in the collection a well-mounted series of Australian and New Zealand insects, and has also presented to the Museum 4,600 specimens of insects, chiefly Coleoptera, collected by him in California. A collection representing 120 species of Lepidoptera from East Africa has been received from Dr. W. L. Abbott, the collector. An interesting collection of West and South African insects collected by Mr. William Harvey Brown, has been received. The collection of insects belonging to the late Dr. Asa Fitch, and purchased by the Department of Agriculture, has been placed in the Museum.

The arrangement of the collection of North American Coleoptera has been completed. Several special researches on entomological subjects, and relating more or less to Museum material, have been made during the year by the curator, and by Messrs. L. O. Howard, of the Department of Agriculture; John B. Smith, formerly assistant curator; W. H. Ashmead, and Lawrence Bruner.

About 15,000 specimens have been added to the collection during the year, and 89 entries have been made in the catalogue.

*Department of Marine Invertebrates.*—Mr. Richard Rathbun, honorary curator, reports increased activity in the work of his department, owing chiefly to the appointment of an assistant curator, Mr. James E. Benedict. All of the material, including the general alcoholic collections in the main storage-rooms, has been kept in excellent condition.

The accessions have been greater in number and of more importance than during the preceding year. A very valuable series of European marine invertebrates was received from Rev. A. M. Norman, of Burnmoor Rectory, Durham, England. The U. S. Commission has transferred to the Museum two very large collections from the Pacific Ocean, gathered by the Fish Commission steamer *Albatross.*

Other accessions deserving special mention were received from Wesleyan College, Middletown, Connecticut; W. H. Brown, naturalist, with the United States Eclipse Expedition to South Africa; the Bureau of Navigation, Navy Department; the U. S. S. *Dolphin,* Commander George F. F. Wilde, commanding; Prof. O. B. Johnson, University of Washington, Seattle, Washington; and Mr. Romyn Hitchcock.

The arrangement of type series of alcholic specimens has been continued. The alcoholic collection of alcyonarians and actinians, and the entire collections of brachyurans and anomourans, have been overhauled, and the card catalogues revised and completed. The assorting of Mr. Dall's Alaskan collection, which has been in progress for several years, has been completed. Much time has been spent in making up sets of duplicates for distribution.

The shore and shallow-water Echini, collected by the U. S. Fish Commission steamer *Albatross* on the west coast of North America in 1888 and 1889, have been identified and a type series deposited in the Museum.

The assistant curator has identified the crustaceans collected by the United States Eclipse Expedition to West Africa, and has begun the study of the Alaskan annelids obtained by Mr. Dall and by the Fish Commission. Prof. Walter Faxon, of the Museum of Comparative Anatomy, Cambridge, Massachusetts, has finished his investigation of the cray-fishes lent to him, and has returned them, together with a report, which has been published in the Proceedings of the Museum.*

*Vertebrate Fossils.*—This department is under the honorary curatorship of Prof. O. C. Marsh, of Yale College, New Haven. Mr. F. A. Lucas, assistant curator of the Department of Comparative Anatomy, has classified and arranged in drawers a portion of a large number of types of the species described by Dr. Leidy.

The most important addition to the collection is a skull of *Thoracosaurus neocesaurus,* presented by Mr. Nelson C. Page.

*Department of Paleozoic Invertebrate Fossils.*—Among the most important accessions to the collection of paleozoic fossils during the year, three are mentioned in the report of the curator. The first is from the British Museum, and includes a large number of trilobites. The second consists of 592 specimens from the Lower Cambrian and the

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* Vol. XII, No. 785, pp. 619-634.

Lorraine formation of Ordovician, transferred by the U. S. Geological Survey. The third, also transferred by the U. S. Geological Survey, is a collection of 178 specimens from the Hudson Terrane of the Ordovician, and 109 specimens from the Upper Silurian.

The curator has been specially interested in the collection of material for the illustration of the middle Cambrian fauna, and in studying the literature of the Cambrian rocks of America. The fossils from the Cincinnati formation of Ohio have been rearranged by Prof. Joseph F. James, and attention has been paid to the exhibition series of crustaceans from the Waterlime formation of New York, and to the collection from the Chazy horizon of New York and Vermont, which has been relabeled and placed upon exhibition. Dr. R. R. Gurley has been employed in labeling and in making a special study upon American graptolites. Twenty-nine accessions have been received during the year. These represent 1,229 individual specimens, including 180 genera, 239 species, and 5 varieties. Five thousand four hundred and twelve entries have been made in the catalogue.

*Department of Mesozoic Invertebrate Fossils.*—Dr. C. A. White, of the U. S. Geological Survey, continues to act as curator of the collection of mesozoic fossils. The pressure of work connected with his duties as an officer of the Geological Survey has rendered it impossible for him to devote more than a small portion of time to Museum matters. Considerable progress has been made in identifying collections transferred to the Museum by the Geological Survey.

The arrangement of the exhibition series has been for the present completed.

### DIVISION OF BOTANY.

*Department of Botany.*—The report of Dr. George Vasey, honorary curator, shows that several collections of considerable value have been added to the National Herbarium during the year.

Among the more important accessions are: A set of 550 species of Japanese plants from S. Tegima, Director of the Educational Museum, Tokio, Japan; 335 specimens collected in Mexico by C. G. Pringle; 1,800 specimens of Southern Californian plants from C. R. Orcutt, San Diego, California; 80 species of Canadian grasses from John Macoun, Geological and Natural History Survey of Canada; 2,817 specimens of Texan plants collected by G. C. Nealley, of Houston, Texas; 900 specimens of East Florida plants from J. H. Simpson, Manatee, Florida; 400 specimens, collected in Lower California and Western Mexico by Edward Palmer; 327 specimens of Californian and Mexican plants, from the California Academy of Science; the first 135 species of a set of Bolivian plants collected by Miguel Bang; about 100 Pacific Slope species from E. L. Greene, Berkeley, California; 142 species of the *Hepaticæ Cubensis Wrightianæ*, from the Harvard University herbarium; 500 specimens from the United States Eclipse Expedition to Africa;

320 species of European mosses from Dr. I. Hagen, Trondhjem, Norway; 800 specimens collected by Frederick V. Coville, of the Department of Agriculture, in Virginia and North Carolina.

The total number of specimens in the National Herbarium is estimated as follows: Mounted, 155,000; duplicates, 18,000.

This portion of the National Herbarium is in great danger owing to the lack of fire-proof rooms in which it can be kept. Dr. Vasey in his report emphasizes the risk of allowing it to continue in inappropriate quarters. He says: "If it were destroyed by fire it could never be entirely replaced, and a large number of type specimens would be lost. The collection of American grasses is the largest in existence, and contains the type specimens of nearly all the species of American grasses described during the last fifteen years."

A new museum building should soon be provided, in which this and several other collections, at present without proper shelter, may be appropriately installed.

*Department of Fossil Plants.*—A series of fossil plants consisting of about 600 specimens, representing as far as practicable the evolutionary development of plant life has been placed on exhibition. A series of labels has been prepared for these specimens and printed.

The duplicate specimens of fossil plants belonging to the Museum are stored in the Armory building, for lack of other space.

The remaining type specimens belonging to the Museum collections, representing the earlier geological formations, have been entirely rearranged during the year.

Professor Ward has been engaged during the year in the preparation of a monograph of the flora of the Laramie group.

The fine Kansas collection of Dakota group plants, purchased from Mr. Charles Sternberg by the Geological Survey, was incorporated with the Museum collections in 1889. This contains 400 types of the plants of the Dakota group, which were studied by Professor Lesquereux.

Mr. Charles S. Prosser, of the Geological Survey, one of Professor Ward's assistants, has recently studied the flora of the Silurian and Devonian formations, and has made extensive collections in various parts of New York.

Mr. David White, of the Survey, has been engaged in the identification of a series of cretaceous plants collected by himself on Martha's Vineyard, and has also commenced the study of a collection of Carboniferous plants from Missouri.

Mr. F. H. Knowlton has studied a collection of fossil wood from Arkansas; and has prepared a report, which will soon be published by the Arkansas Geological Survey. He has also published a paper upon the fossil wood of the Potomac formation, in which several new species are described; this publication also contains an elaborate review of the literature relating to the study of internal structure, from its earliest mention down to the close of the year 1886.

During the summer of 1889 Mr. Knowlton made collections of fossil plants in New Mexico and Arizona, discovering eight or ten localities from which fossil plants had not been before reported. His collections include a valuable and exceedingly interesting series of Triassic plants from the copper mines near Abiquiu. He also visited the celebrated fossil forest in the vicinity of Holbrook, Arizona, where several hundreds of acres are covered by immense trunks of fossil trees. A large collection of fossil wood was obtained in this locality. He also made a collection of fossil wood from the fossil forest at Calistoga, California. On his return in the fall, he commenced the selection of a series of type specimens from collections made in previous years in the Yellowstone National Park.

*Section of Forestry.*—Dr. B. E. Fernow, chief of the Division of Forestry in the Department of Agriculture, has, as stated in the report for 1889, taken charge of the forestry collection in the Museum.

It had been expected that the material used in the exhibit prepared by the Department of Agriculture for the World's Exposition at Paris in 1889 would be returned, and form a nucleus for a systematic Museum exhibit. The bulk of the material was, however, at the request of the director of the Jardin des Plantes, in Paris, turned over to that establishment by the representative of the Department of Agriculture.

During the year five exhibits received through the Department of Agriculture have been installed. To the panel exhibiting the forestry interests of the United States, and referred to in Dr. Fernow's report for 1889, two maps from the Census Bureau have been added. These show the distribution of forest, prairie and plain, and of the different forest types as described by Prof. C. S. Sargent.

The collection of the woods of the United States, which was prepared by the Department of Agriculture for the Cincinnati Exposition, has been arranged in four cases.

It is the wish of the curator to make a complete representation of the arborescent flora of the United States, and also a comprehensive exhibit of the more important timber trees, as soon as opportunity shall be afforded.

## DIVISION OF GEOLOGY.

*Department of Minerals.*—The appearance of the exhibition hall devoted to the display of minerals has been greatly improved during the year. Prof. F. W. Clarke, honorary curator, reports that the collection has in a great measure been rearranged, and that a new installation of the gem collection has been commenced. A special feature of the year's work has been the preparation of a large number of duplicate collections of minerals for distribution to schools and colleges. The distributions, which have already been made, are referred to in the statement concerning the work of the Department of Registration and Storage. Among the most important accessions are a large series of minerals from Missouri and Arkansas, collected by Mr. W. P. Jenney, and a collection of Arizona minerals, collected by Dr. W. F. Hillebrand and transmitted by the U. S. Geological Survey. Specimens of ten meteorites have been received during the year, six of which were acquired by exchange with the British Museum and the Museum of Natural History in Paris.

*Department of Geology.*—Mr. Merrill, curator of this department, states that a very large portion of his time since October, 1889, has been devoted to the assorting of collections, the preparation of labels, and the identification of material sent to the Museum for examination and report. Sixty-nine lots of material have thus been named and reported upon during the year. Mr. Merrill has prepared in his report a careful synopsis of the plan which he has devised for the rearrangement of the exhibition series. The number of specimens now in the exhibition series is estimated at 16,762. The entries in the catalogue of the Department of Metallurgy during the year were 504 in number. In the catalogue heretofore devoted to the Department of Lithology and Physical Geology 2,268 entries have been made.

## G.—REVIEW OF THE ADMINISTRATIVE WORK.

### PROGRESS OF GENERAL AND INCIDENTAL WORK.

### Registration and Storage.

Mr. S. C. Brown, registrar, has prepared the tabulated statement here printed, showing the number of packages received at the Smithsonian Institution during the year:

| | |
|---|---|
| Books, number of volumes | 41,300 |
| Miscellaneous packages for Smithsonian Institution | 7,716 |
| Loads of specimens and supplies | 42 |
| Packages containing Museum specimens | 827 |
| Packages containing Museum supplies | 1,688 |
| Personal packages | 506 |
| Total number of packages received | 52,079 |

The number of packages sent out both from the Smithsonian Institution and the National Museum was 2,154.

### Distribution of Duplicates.

The distribution of duplicate specimens has been continued, and 308 packages of specimens, as shown in the accompanying table, have been sent out during the year. The larger part of these contained specimens presented to schools and colleges for use in connection with their scientific work.

### DISTRIBUTION OF SPECIMENS.

*Arranged by departments in the Museum.*

| Department. | No. of packages sent out. | Department. | No. of packages sent out. |
|---|---|---|---|
| Materia medica | 4 | Marine invertebrates | 50 |
| Textile industries | 2 | Comparative anatomy | 2 |
| Oriental antiquities | 5 | Invertebrate fossils | 6 |
| Ethnology | 20 | Plants | 5 |
| Pottery | 5 | Minerals | 74 |
| Prehistoric anthropology | 8 | Lithology and physical geology | 13 |
| Mammals | 22 | Metallurgy | 7 |
| Birds | 20 | Direct exchanges | 7 |
| Birds' eggs | 1 | Photographs and plans of cases, etc | 5 |
| Reptiles and batrachians | 9 | Returned to owner | 107 |
| Fishes | 8 | Total | 308 |
| Mollusks | 5 | | |
| Insects | 3 | | |

The transmission of specimens to museums and colleges, at home and abroad, has been actively carried on, especially in connection with the department of minerals, a large quantity of duplicate material having been obtained last summer by Prof. F. W. Clarke, Curator of Minerals, especially for this purpose.

Numerous exchanges of specimens have also been completed. The following statement, arranged geographically, contains the names of the recipients of the material sent out, the character of the specimens, and the conditions under which transmitted, *i. e.*, whether as a gift or in exchange.

*Geographical statement of the distribution of specimens during the year ending June* 30, 1890.

### FOREIGN COUNTRIES.

AFRICA. Department of Public Instruction, Cape Town: Dried insects (295 specimens) in exchange. (D.* 6359.)

AUSTRALIA. Australian Museum, Sydney, New South Wales: Two boxes of alcoholic fishes, and skeleton of Great Auk in exchange. (D. 5965.)

School of Arts, Newcastle, New South Wales: Minerals (set 43). Gift. (D. 6290.)

AUSTRIA. Dr. A. Brezina, Vienna: Rocks (41 specimens) in exchange. (D. 6067.)

BAVARIA. University of Munich, Munich: Minerals (136 specimens) in exchange. (D. 6271.)

BELGIUM. Prof. Ernest van den Broeck, Brussels: Rocks (16 specimens) in exchange. (D. 6284.)

BRITISH GUIANA. The Colonial Museum, Demerara: Birds' skins (37 specimens) in exchange. (D. 6056.)

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* D. refers to the distribution record kept by the registrar.

ENGLAND. Henry Balfour, Oxford: Zuñi pottery (8 specimens) and flaked implements (24 specimens) in exchange. (D. 6360.)

Edward Bartlett, Kent: Birds' skins (48 specimens) in exchange. (D. 6C43.)

British Museum, London: Minerals (15 specimens) in exchange. (D. 6275.)

Edward Lovett, Croydon, Surrey: Ethnological specimens (135) in exchange. (D. 6071.)

Oxford University Museum, Oxford: Stone implements (7 specimens) and 1 Kadiak lamp in exchange. (D. 6178.)

Rev. A. M. Norman, Fence Houses, Durham: Specimens of Echini (14) and two boxes of duplicate marine invertebrates in exchange. (D. 6253.) (D. 6342.)

FRANCE. Mineral Laboratory, College of France, Paris: Minerals (33 specimens) in exchange. (D. 6257.)

GERMANY. Dr. August Müller, Berlin: Birds' skins (29 specimens) in exchange. (D. 6049.)

Royal University of Berlin, Berlin: Collection of batrachians in exchange. (D. 6243.)

Royal Ethnological Museum, Dresden: Twenty casts of Indian heads in exchange. (D. 6220.)

Hans Graf von Berlepsch, Münden: Birds' skins (108 specimens) in exchange. (D. 6096.)

Dr. Adolph Nehrkorn, Braunschweig: Birds' skins (20 specimens) in exchange. (D. 6045.)

HUNGARY. National Museum, Buda-Pesth: Birds' skins (36 specimens) in exchange. (D. 6095.)

ICELAND. Icelandic Natural History Society, Reykjavik: Two boxes of duplicate marine invertebrates in exchange. (D. 6336.)

INDIA. Government Central Museum, Madras: Birds' skins (55 specimens) in exchange. (D. 6102.)

ITALY. Dr. Paulo Mantegazza, Florence: Archæological specimens (55) in exchange. (D. 6237.)

Zoological Museum, Royal University, Florence: Ethnological specimens (24) in exchange, and archæological and ethnological specimens (35) in exchange. (D. 5982.) (D. 6236.)

JAPAN. Tokio Educational Museum, Tokio: Botanical specimens (400) in exchange. (D. 6108.)

SYRIA. Syrian Protestant College, Beirut: Four boxes alcoholic reptiles, batrachians, rocks, birds' skins, marine invertebrates, and 1 box of minerals (set 1.) (D. 6006.) (D. 6177.)

## UNITED STATES.

ALABAMA. State Agricultural and Mechanical College, Auburn: Minerals (set 20). Gift. (D 620.)

State Normal School, Jacksonville: Minerals (set 26). Gift. (D. 6215.)

COLORADO. Museum of the Denver Chamber of Commerce, Denver: Two models of cliff-dwellings. Gift. (D. 6004.)

DISTRICT OF COLUMBIA. George H. Boehmer, Washington: Zuñi pottery (14 specimens) in exchange. (D. 6109.)

Catholic University, Brookland: Minerals (18 specimens) and rocks (30 specimens). Gift. (D. 6119.)

GEORGIA. N. P. Pratt, esq., Atlanta: Minerals (11 specimens) in exchange. (D. 6047.)

ILLINOIS. Lake High School, Lake: Minerals (set 30). Gift. (D. 6219.)

Peoria Scientific Association, Peoria: Minerals (set 46). Gift. (D. 6318.)

Central Illinois Scientific Association, Virginia: Two boxes duplicate marine invertebrates. Gift. (D. 6289.)

Charles K. Worthen, Warsaw: Birds' skins (27 specimens) in exchange. (D. 6093.) (D. 6135.)

INDIANA. De Pauw University, Greencastle: West coast fishes (set 7). Gift. (D. 6279.)

Hanover College, Hanover: Minerals (set 32). Gift. (D. 6225.)

John W. Spencer, Paxton: Corals (32 specimens) in exchange. (D. 6280.)

State Normal School, Terre Haute: West coast fishes (set 42). Gift. (D. 6278.)

IOWA. Coe College, Cedar Rapids: West coast fishes (set 66). Gift. (D. 6288.)

The Clinton High School, Clinton: Minerals (set 14). Gift. (D. 6198).

High School, Council Bluffs: Marine invertebrates (series IV, set 161). Gift. (D. 6144.)

Simpson College, Indianola: Minerals (set 23). Gift. (D. 6212.)

State University of Iowa, Iowa City: Specimen of Pentacrinus. Gift. (D. 5967.)

Western Normal School, Shenandoah: Two boxes of marine invertebrates. Gift. (D. 6281.)

KANSAS. College of Emporia, Emporia: Minerals (set 49). Gift. (D. 6344.)

State Normal School, Emporia: Minerals (set 29). Gift. (D. 6218.)

Ottawa University, Ottawa: Marine invertebrates (series IV, set 158.) Gift. (D. 6123.) Minerals (set 15). Gift. (D. 6199.)

KENTUCKY. Berea College, Berea: Minerals (set 24). Gift. (D. 6213.)

Central University, Richmond: Minerals (set 47). Gift. (D. 6339.)

LOUISIANA. New Orleans University, New Orleans: Marine invertebrates (series IV, set 162). Gift. (D. 6151.)

Gilbert Seminary, Winsted: Minerals (set 36). Gift. (D. 6230.)

MAINE. George L. Brigham, Bolton: Minerals (50 specimens) in exchange. (D. 6264.)

Lorin B. Merrill, Paris: Minerals (49 specimens) in exchange. (D. 6263.)

Colby University, Waterville: Rocks (13 specimens) in exchange, and minerals (set 39). Gift. (D. 6201.) (D. 6260.)

MARYLAND. St. John' College, Annapolis: Marine invertebrates (series IV, set 170). Gift. (D. 6361.)

Woman's College of Baltimore, Baltimore: Minerals (set 18). Gift. Marine invertebrates (series IV, set 163). Gift. (D. 6205.)

MASSACHUSETTS. Massachusetts Agricultural College, Amherst: Marine invertebrates (series IV, set 168). Gift. (D. 6347.)

George H. Barton, Boston: Geological specimens (41) in exchange. (D. 6039.)

Boston Society of Natural History, Boston: Alcoholic fishes of east coast (54 specimens) in exchange. (D. 6157.)

Barnum's Museum, Tuft's College, College Hill: Twelve casts of fishes, 6 casts of cetaceans, 10 antiquities, marine invertebrates (118 specimens) in exchange. (D. 6265.)

Peabody Museum, Cambridge: Twelve boxes Indian pottery, 4 boxes of Indian costumes in exchange. (D. 6013.) (D. 6074.) (D. 6158.)

Clark University, Worcester: Marine invertebrates (series IV, set 155). Gift. (D. 5960.)

MICHIGAN. Michigan Agricultural College, Lansing: Collection of fibers. Gift. (D. 6267.)

MINNESOTA. Minnesota Academy of Sciences, Minneapolis: Minerals (set 57). Gift. (D. 6242.)

MISSOURI. Missouri School of Mines, Rolla: Minerals (set 54). Gift. (D. 6354.)

MONTANA. College of Montana, Deer Lodge: Minerals (set 31). Gift. (D. 6224.)

NEBRASKA. Doane College, Crete: Minerals (set 51). Gift. (D. 6348.)

University of Nebraska, Lincoln: Minerals (set 50). Gift. (D. 6345.)

Gates College, Neligh: Minerals (set 53). Gift. (D. 6350.)

Creighton College, Omaha; Minerals (set 52). Gift. (D. 6349.)

Nebraska Institute for the Deaf and Dumb, Omaha: Minerals (set 55). Marine invertebrates (set 169). Gift. (D. 6355.)

Nebraska State Normal School, Peru: Minerals (set 45). Gift. (D. 6317.)

NEW HAMPSHIRE. High School, North Charlestown: Minerals (set 9). Gift. (D. 6193.)
High School, Franklin: Minerals (set 8). Gift. (D. 6192.)

NEW JERSEY. High School, Bloomfield: Minerals (set 34). Gift. (D. 6228.)
South Jersey Institute, Bridgeton: Marine invertebrates (set 166.) Gift. (D. 6256.)

NEW YORK. Cornell University, Ithaca: Four boxes of textiles, Indian foods, etc., in exchange. (D. 6017.)
American Museum of Natural History, New York: Skin, skull, and bones of bison in exchange. (D. 5949.) Birds' skins (10 specimens) in exchange. (D. 6065.)
College of the City of New York, New York: Minerals (set 38). Gift. (D. 6249.)
Columbia School of Mines, New York: Minerals (19 specimens) in exchange. (D. 5333.)
Prof. J. J. Stevenson, New York: Rocks and ores (15 specimens) in exchange. (D. 6316.)
University of the City of New York, New York: Ores (125 specimens) in exchange. (D. 5939.) Cretaceous and Tertiary fossils (48 specimens) in exchange. (D. 6029.) Cambrian fossils (12 specimens) in exchange. (D. 6334.)
High School, Olean: Marine invertebrates (series IV, set 164). Gift. (D. 6227.)

NORTH CAROLINA. United States Assay Office, Charlotte: Minerals (set 4). Gift. (D. 6188.)
C. W. Kessler, Charlotte: Minerals (83 specimens) in exchange. (D. 6287.)

OHIO. Cincinnati Society of Natural History, Cincinnati: Specimen of *Pentacrinus*. Gift. (D. 6165.) Two boxes of duplicate marine invertebrates in exchange. (D. 6325.)
Ohio Wesleyan University, Delaware: Minerals (set 25). Gift. (D. 6214.)
Oberlin College, Oberlin: Ethnological material (73 specimens) in exchange. (D. 5981.) Specimen of Pentacrinus. Gift. (D. 6014.) Two boxes of marine invertebrates in exchange. (D. 6088.) Birds' skins (42 specimens) in exchange. (D. 6170.) Minerals (set 42). Gift. (D. 6283.)

OREGON. State Agricultural College, Corvallis: Minerals (set 33). Gift. (D. 6226.) Marine invertebrates (series IV, set 165). Gift. (D. 6226.)

PENNSYLVANIA. Muhlenberg College, Allentown: Marine invertebrates (set 159). Minerals (set 22). Gift. (D. 6133.) (D. 6211.)
Central State Normal School, Lock Haven: Minerals (set 16). Gift. (D. 6200.)
Academy of Natural Sciences, Philadelphia: Two boxes duplicate marine invertebrates in exchange. (D. 6209.)
Convent of the Sacred Heart, Philadelphia: Shells (85 specimens). Gift. (D. 6338.)
Dr. Heilbron Cresson, Philadelphia: One box of stone implements in exchange. (D. 6118.)
Wagner Free Institute of Science, Philadelphia: Specimen of *Pentacrinus*. Gift. (D. 5954.) Minerals (63 specimens) in exchange. (D. 6207.) Two boxes duplicate marine invertebrates in exchange. (D. 6292.)
George Vaux, jr., Philadelphia: Minerals (41 specimens) in exchange. (D. 6305.)
Pittsburgh Female College, Pittsburgh: Minerals (set 2). Gift. (D. 6183.)

RHODE ISLAND. Brown University, Providence: Dried plants (71 specimens) in exchange. (D. 6131.)

SOUTH CAROLINA. Charleston Museum, Charleston: Birds' skins (3 specimens). Gift. (D. 6050.)
Arthur T. Wayne, Charleston: Birds' skins (2 specimens) in exchange. (D. 6086.)
University of South Carolina, Columbia: Marine invertebrates (series IV, set 157). Gift. (D. 6112.)

SOUTH DAKOTA. Dakota Agricultural College, Brookings: Minerals (set 5). Gift. (D. 6189.)

South Dakota Normal School, Madison: Minerals (set 6). Gift. (D. 6190.)

Dakota University, Mitchell: Minerals (set 35). Gift. (D. 6229.) Marine invertebrates (series IV, set 167). Gift. (D. 6300.)

Pierre University, Pierre: Minerals (set 27). Gift. (D. 6216.)

Redfield College, Redfield: Minerals (set 7). Gift. (D. 6191.)

University of South Dakota, Vermillion: Minerals (set 48). Gift. (D. 6340.)

TENNESSEE. University of Tennessee, Knoxville: Minerals (set 11). Gift. (D. 6195.)

Sweetwater Female Institute, Sweetwater: Minerals (set 12). Gift. (D. 6196.)

TEXAS. University of Texas, Austin: Minerals (set 28). Gift. (D. 6217.)

State Agricultural and Mechanical College, College Station: Minerals (set 13). Gift. (D. 6197.)

VERMONT. Brattleboro Society of Natural History, Brattleboro: Minerals (set 40). Gift. (D. 6261.)

Ira R. Allen, Fair Haven: Minerals (145 specimens) in exchange. (D. 6286.)

VIRGINIA. Emory and Henry College, Emory: Minerals (set 17). Gift. (D. 6202.)

Virginia Normal and Collegiate Institute, Petersburgh: Minerals (set 19). Gift. (D. 6204.)

WISCONSIN. Lawrence University, Appleton: Marine invertebrates (series IV, set 156). Gift. (D. 5986.)

Elkhorn High School, Elk Horn: Minerals (set 21). Gift. (D. 6210.)

University of Wisconsin, Madison: One box of Cambrian fossils. Gift. (D. 5998.) Marine invertebrates (series IV, set 160). Gift. (D. 6193.) Minerals (set 3). Gift. (D. 6184.)

State Normal School, Milwaukee: Minerals (set 41). Gift. (D. 6232.)

Public School, Palmyra: Minerals (set 10). Gift. (D. 6194.)

WYOMING. Public School of Cheyenne, Cheyenne: Minerals (set 44). Gift. (D. 6291.)

## STORAGE.

During the year there were entered upon the temporary storage-records of the Museum 361 boxes.

There were removed from storage and turned over to the officers of the Museum 119 boxes, to be opened and worked into the collections of the Museum.

## LIBRARY.

Mr. John Murdoch, librarian, has furnished the following statement concerning the operations of the library.

The total number of publications added to the library during the year was 12,437 (1,479 volumes of more than 100 pages, 2,250 pamphlets, 8,672 parts of regular serials, and 36 charts). Of these, 785 volumes, 1,010 pamphlets, and 6,900 parts of serials were retained for the use of the Museum from the accessions of the Smithsonian Institution. The remainder were obtained, as usual, by gift, exchange, and purchase.

The only notable gift to the library during the year was from the Wagner Free Institute of Science, in Philadelphia, consisting of a nearly complete set of Kiener's "Iconographie des Coquilles vivantes," with magnificent colored plates. The Lea collection, referred to in the last report, has been duly entered and catalogued.

During the year 7,596 books were borrowed from the library and 4,268 returned. Ninety-two persons are now authorized under the regulations to draw books from the Museum library. Two hundred and forty-eight requests were sent to the Library of Congress during the year. Three thousand two hundred and seventy titles have been added to the card catalogue.

Since the last report the sectional libraries of Lithology and Metallurgy have been combined, forming the section of Geology, under the charge of Mr. G. P. Merrill, and the sectional library of Transportation and Engineering, in charge of Mr. J. E. Watkins, has been organized.

The usual inspection of the sectional libraries was made between May 1 and June 10, and the books were found to be in good condition.

The number of books assigned to these libraries is as follows:

*Birds.*—540 volumes, 31 pamphlets, and 177 parts of serials.

*Editor, Smithsonian Institution.*—601 volumes and pamphlets, 546 parts.

*Ethnology.*—143 volumes, 20 pamphlets, 143 parts.

*Fishes.*—82 volumes, 8 pamphlets, 38 parts.

*Geology.*—536 volumes, 308 pamphlets, 412 parts, 32 charts.

*Insects.*—466 volumes, 267 pamphlets, 621 parts.

*Mammals.*—187 volumes, 313 pamphlets.

*Marine Invertebrates.*—65 volumes, 3 pamphlets, 118 charts.

*Materia Medica.*—235 volumes, 4 pamphlets, 269 parts.

*Mesozoic Fossils.*—35 volumes, 10 pamphlets, 13 parts.

*Mineralogy.*—A. 177 volumes, 6 pamphlets, 281 parts; B. 72 volumes, 48 pamphlets, 8 parts.

*Mollusca and Cenozoic Fossils.*—76 volumes, 13 pamphlets, 270 parts.

*Oriental Archæology.*—225 volumes, 94 pamphlets, 283 parts.

*Plants, Recent and Fossil.*—380 volumes, 204 pamphlets, 886 parts.

*Prehistoric Anthropology.*—66 volumes, 17 pamphlets, 49 parts (in addition to the Rau Memorial Library, which is not yet wholly catalogued).

*Textiles and Foods.*—27 volumes, 43 pamphlets, 30 parts.

*Transportation and engineering.*—46 volumes, 292 parts.

The books referred to in the last report as having been sent to the Government bindery were all bound and returned to the library by August 15, 1889.

The assignment of additional clerical assistance to the library has enabled the librarian to dispose of a considerable portion of the accumulated arrears of cataloguing and other similar work, and it will soon be possible to begin the much-needed subject-catalogue.

Eight new book-cases have been built in the passage-way adjoining the library. By filling these with classes of books less often referred to, relief was obtained for the crowded cases in the library, but the latter are rapidly filling up again.

The library grows so fast that any temporary measures like those mentioned are of little real moment. The library needs a room large enough to allow for the expansion, and at the same time to permit a rational classification of the books upon the shelves.

## FOREIGN EXCHANGES.

Exchanges of duplicate specimens, in continuation of the custom of previous years, have been carried on. The domestic exchanges are indicated in the accession list (section V), and the following statement relates only to exchanges made with individuals and scientific establishments outside of the United States.

*Arts and industries.*—The Sapporo Agricultural College, Sapporo, Japan, through Shosuke Sato, acting director, sent in exchange a collection of Aino articles, consisting of a dried fish, wooden dipper and spoon, fish-bowl, rice-bowl, tray, an "ikoro," man's coat, woman's coat, belt, apron, pair of leggings, bow and quiver with arrows, loom and two harpoons of different forms, for which an equivalent is to be sent.

The Insetsu Kioku (finance department), Tokio, Japan, through Mr. T. Tokuno, chief, sent samples of Japanese woodcuts, printing and engraving tools and a few samples of Japanese printing. This collection illustrates Japanese methods of engraving. An exchange was sent in return for these, consisting of a set of apparatus, tools, books, catalogues and other materials relating to the photomechanical processes in use in the United States.

*Ethnology.*—The Museum of Natural History, Paris, France, sent 52 samples of hair of various races, representing fourteen different types of mankind.

A saucer-shaped lamp made of pottery from Cyprus was received from Mr. Henry Balfour, of the Museum, Oxford, England, for which a Kadiak stone lamp, and some rude stone implements from the District of Columbia, were sent in exchange. Through Mr. Henry Balfour, in behalf of the Museum, was received a model of a Hindoo fire-drill, for which 3 models of fire-drills were sent in exchange.

From the Ethnological Museum, Berlin, Germany, were received ethnological objects collected from Morocco, Wasaguan Indians, Africa, Paola, South Pacific Ocean, New Caledonia, and Adansonia, for which a collection of 240 stone implements was sent in exchange.

Numerous exchanges of ethnological specimens have been made with Mr. Edward Lovett, of Croydon, England.

*Prehistoric anthropology.*—Six specimens of Carib stone celts from the West Indies were received from Mr. Henry Balfour, Oxford, England, for which 8 pieces of Zuñi pottery and 25 flaked stones from Piney Branch, near Washington, D. C., were sent in exchange.

*Mammals.*—A collection of mammal skins was received from Louis Molnar, Molna Szecsöd, Hungary. For these skins an exchange consisting of birds' skins was sent. This is referred to under the heading of *Birds*.

The British Museum, London, England, sent a skull of *Lutra felina.*

From the Museum of Natural History, Genoa, Italy, through Marquis Giacoma Doria, director, were received a skin and skull of *Lophiomys inhausii;* 100 bats in alcohol, 2 shrews, and 1 Meadow-mouse. An equivalent for this valuable collection will be prepared at as early an opportunity as possible.

*Birds.*—Louis Molnar, Molna Szecsöd, Epyházos Hollos, Hungary, sent in exchange 86 specimens of birds' skins, representing 71 species, from Hungary, for which 92 specimens of birds' skins were sent in exchange. This was also sent in exchange for the mammal skins mentioned above.

From the museum at Demerara, British Guiana, through Mr. J. J. Quelch, were received 4 skins of adult Hoatzins (*Opisthocomus cristatus*), and 7 young specimens of the same species in alcohol; also 2 skeletons. For these, 37 specimens of birds' skins were sent in exchange.

A. Nehrkorn, Riddagshausen, Braunschweig, Germany, sent 5 birds' skins, representing 5 species, from Palawan, for which similar material was sent in exchange.

Mr. T. McIlwraith, Hamilton, Ontario, Canada, sent 4 specimens representing 4 species of birds from British Columbia. Birds' skins were sent in exchange for this collection.

*Fishes.*—From the Australian Museum, through Prof. Edward P. Ramsay, curator, was received a collection of Percoid fishes, in exchange for a collection of fishes and a skull of the Great Auk. A collection of fishes, together with a skin of *Antilocopra americana* and a skull of American bison, will also be sent in exchange.

*Insects.*—From Prof. Targioni Tozzetti, were received 31 specimens of European *Microlepidoptera,* representing 8 species. In exchange for this collection, 29 specimens of European Orthoptera, representing 8 species, were sent.

Vicomte R. Du Brysson, France, sent 77 specimens, representing 26 species of *Chrysididæ,* well mounted and named. An equivalent in material desired has been sent.

Prof. R. Gestro, Genoa, Italy, sent 14 species of blind Coleoptera, from the Mediterranean countries, in return for which entomological material has been transmitted.

From J. H. Brady, Department of Public Education, Cape Town, Africa, through Mr. William Harvey Brown, a collection of Coleoptera from South Africa was received, for which 295 specimens, representing 87 species, of dried insects, were sent in exchange.

*Marine invertebrates.*—Duplicate specimens of 8 rare species of Echini were sent to the Rev. A. M. Norman, England, as a partial equivalent for the valuable collections which have been received from him at various times.

*Invertebrate fossils* (*Paleozoic*).—From the British Museum, London, England, have been received in exchange for Lower Cambrian fossils, 57 specimens of Cambrian, Lower Silurian, and Upper Silurian fossils. These specimens represent 25 genera and 35 species.

*Botany.*—Dr. I. Hagen, of Trondhjem, Norway, sent in exchange a fine collection of Norwegian mosses, representing 320 species. A partial equivalent for this collection has been already transmitted, and a further sending will be made before long.

*Minerals.*—From the Royal Museum, Stockholm, Sweden, were received specimens of minerals from Sweden, Norway, Finland, and Greenland. This collection was sent in exchange for a collection of minerals which had been previously transmitted.

The Museum of Natural History, Paris, France, has sent in exchange for minerals received, a meteoric stone from Aumale, Algeria, and two meteorites.

From the Australian Museum, Sydney, New South Wales, through the U. S. Geological Survey, were sent in exchange 32 specimens of Australian minerals and rocks.

The British Museum, London, England, sent 3 casts of meteors and a specimen of orpiment, also 86 specimens of minerals. Three boxes of minerals were sent in exchange for this collection.

## PUBLICATIONS.

In the report for 1889 (pp. 54–65) the history and condition of the publications of the National Museum are fully discussed. The increase in the publication fund, which would have made possible a more generous distribution of the volumes of "Proceedings" and the "Bulletin," has not been allowed by Congress.

To meet the numerous applications for the volumes of these publications, the following circular was printed:

### CIRCULAR RELATING TO THE PUBLICATIONS OF THE UNITED STATES NATIONAL MUSEUM.

The Smithsonian Institution will probably find it necessary to discontinue the republication of the Proceedings and Bulletins of the National Museum for distribution to libraries, the cost being found too heavy a burden upon its limited publication fund.

Congress has been asked to increase the annual appropriation for the Museum publications, in order that every important library and institution of learning may be supplied with a full series of those hereafter to be issued. Should Congressional action be favorable, a request will be made for the republication of the back volumes for the use of the same libraries and institutions.

In the meantime the publications of the years 1888 and 1889 will be sent to a limited list of libraries, chiefly scientific, in the United States and abroad.

Bulletins No. 17 to No. 32, and Proceedings, Vols. V to XI, inclusive, can not be supplied at present. Bulletins No. 1 to No. 16, and Proceedings, Vols. I to IV, are included in the Smithsonian series of Miscellaneous Collections.

The number of copies of the earlier publications, printed under the authority of the Interior Department, was very small, and a few copies placed at the disposal of the National Museum were used for distribution to scientific societies and museums, and to individual specialists and in exchange for collections.

The applications for the Museum publications are now so numerous as to render it impossible to continue the sending out of full volumes of the Proceedings or complete series of the Bulletins to individuals.

So far as possible, each scientific correspondent of the Smithsonian Institution and National Museum will be supplied with publications essential for his use in the field of investigation in which he is individually engaged.

S. P. LANGLEY,
*Secretary.*

SMITHSONIAN INSTITUTION, *Washington, D. C.*

The custom of printing the Proceedings signature by signature, which was maintained during the publication of the first eleven volumes, has now been discontinued, for reasons given on page 58 of the last report. Commencing with Vol. XII, a limited number of copies of each paper is printed in advance of the bound volume, for distribution to specialists. These are distributed as soon as received from the Government Printing Office. The bound volumes are now reserved for public libraries and other educational establishments, whose publications the Museum receives in exchange.

*Reports of the National Museum.*—During the year the reports of the Museum (constituting Part II of the Smithsonian Report) for 1886 and 1887 have been published. The report for 1888 has been put in type, and the manuscript prepared for the report for 1889.

The report for 1886 was issued in October, 1889, and contains xi+842 pages. The volume contains the following special papers relating to and illustrative of collections in the Museum:

The Meteorite Collection in the National Museum: A Catalogue of Meteorites represented November 1, 1886. By F. W. Clarke.

The Gem Collection. By George F. Kunz.

The Collection of Building and Ornamental Stones: A Handbook and Catalogue. By George P. Merrill.

The Collection of Textiles: list of Fibers and Fabrics. By Romyn Hitchcock.

Instructions for Preparing Microscopical Mounts of Vegetable Textile Fibers. By Romyn Hitchcock.

Instructions for Collecting Skins of Mammals, for Study or Mounting. By William T. Hornaday.

The report for 1887 was issued in December, 1889, and contains xviii+771 pages. The special papers based upon collections in the Museum and published in the report are:

Cradles of the American Aborigines. By Otis T. Mason.

Notes on the Artificial Deformation of Children among Savage and Civilized Peoples. (With a biography.) By Dr. J. H. Porter.

The Human-Beast of Burden. By Otis T. Mason.

Ethno-Conchology: A Study of Primitive Money. By Robert E. C. Stearns.

A Preliminary Catalogue of the Eskimo Collection in the U. S. National Museum, arranged geographically and by uses. By Lieut. T. Dix Bolles, U. S. Navy.

The Extermination of the American Bison. With a Sketch of its Discovery and Life History. By William T. Hornaday.

The Preservation of Museum Specimens from Insects and the effects of Dampness. By Walter Hough.

*Proceedings of the U. S. National Museum.*—The extension of the scope of the National Museum during the past few years, and the activity of the collectors employed in its interest, have caused a great increase in the amount of material in its possession. Many of the objects gathered are of a novel and important character, and serve to throw a new light upon the study of nature and of man. The importance to science of prompt publication of descriptions of this material led to the establishment of the present series of publication, in 1878, entitled "Proceedings of the United States National Museum." The papers in the Proceedings consist chiefly of papers prepared by the scientific corps of the National Museum, and of papers by other investigators, founded upon the collections in the National Museum.

Volume XI, for 1888, was issued in October, 1889. It contains 714 pages, 60 plates, and 122 text figures. The volume contains 85 papers by 43 authors, 19 of whom are connected with the National Museum. The papers relate to the following subjects:

| Subject. | No. of papers. | Subject. | No. of papers. |
|---|---|---|---|
| Birds | 14 | Mammals | 9 |
| Chemistry | 2 | Mineralogy | 1 |
| Ethnology | 11 | Mollusks | 4 |
| Fishes | 20 | Osteology | 3 |
| Fossil animals | 1 | Recent plants | 3 |
| Fossil plants | 6 | Reptiles | 4 |
| Geology | 3 | Total | 85 |
| Insects | 4 | | |

Nineteen signatures (304 pages) of volume XI had been published before the beginning of the fiscal year covered by this report. The remainder were published on the following dates:

Nos. 20–27, on July 5, 1889.
Nos. 28–33, on September 3, 1889.
Nos. 34–35, on September 20, 1889.
Nos. 36–41, on September 25, 1889.
No. 42, on September 27, 1889.

Commencing with volume XII, the method of publishing the separate papers was changed, for reasons already explained. The bound volume has not yet been received from the Public Printer. A list of the titles of the separate papers with the names of the authors, is here given:

No. 761. A Review of the Genus Xiphocolaptes of Lesson. By Robert Ridgway. Pp. 1–20.

No. 762. A Review of the Genus Sclerurus of Swainson. By Robert Ridgway. Pp. 21–31.

No. 763. Descriptive Notes of New Genera and species from the Lower Cambrian or Olenellus Zone of North America. By Charles D. Walcott. Pp. 33–46.

No. 764. New North American Acrididae found North of the Mexican Boundary. By Lawrence Bruner. Pp. 47–82.

No. 765. Contribution to the History of Pallas' Cormorant. By Leonhard Stejneger. Pp. 83–94.

No. 766. Description of Two New Species of Snakes from California. By Leonhard Stejneger. Pp. 95–99.

No. 767. Scientific Results of Explorations by the U. S. Fish Commission Steamer *Albatross*. No. I. Birds collected on the Galapagos Islands in 1888. By Robert Ridgway. Pp. 101–128.

No. 768. Scientific Results of Explorations by the U. S. Fish Commission Steamer *Albatross*. No. II. Birds collected on the Island of Santa Lucia, West Indies, Abrolhos Islands, Brazil, and at the Straits of Magellan in 1887–'88. By Robert Ridgway. Pp. 129–139.

No. 769. Scientific Results of Explorations by the U. S. Fish Commission Steamer *Albatross*. No. III. Report on the Batrachians and Reptiles collected in 1887–'88. By E. D. Cope. Pp. 141–147.

No. 770. Scientific Results of Explorations by the U. S. Fish Commission Steamer *Albatross*. No. IV. Description of New Species of Fishes collected at the Galapagos Islands and along the Coast of the United States of Colombia, 1887–'88. By David Starr Jordan and Charles Harvey Bollman. Pp. 149–183.

No. 771. Scientific Results of Explorations by the U. S. Fish Commission Steamer *Albatross*. No. V. Annotated Catalogue of the Insects collected in 1887–'88. By L. O. Howard. Pp. 185–216.

No. 772. Scientific Results of Explorations by the U. S. Fish Commission Steamer *Albatross*. No. VI. List of the Plants collected in Alaska in 1888. By Dr. George Vasey. Pp. 217–218.

No. 773. Scientific Results of Explorations by the U. S. Fish Commission Steamer *Albatross*. No. VII. Preliminary Report on the Collection of Mollusca and Brachiopoda obtained in 1887–'88. By William Healey Dall. Pp. 219–362.

No. 774. Notes on the Occurrence of Gillichthys Y-Cauda at San Diego, California. By Charles H. Gilbert. P. 263.

No. 775. Description of a New Genus and Species of Inarticulate Brachiopod from the Trenton Limestone. By Charles D. Walcott. Pp. 365–366.

Nos. 776, 777. I. The Archæology of the Potomac Tide-water Region. By Otis T. Mason. II. The Palæolithic Period in the District of Columbia. By Thomas Wilson. Pp. 367–376.

No. 778. Notes on a Third Collection of Birds made in Kauai, Hawaiian Islands, by Valdemar Knudsen. By Leonhard Stejneger. Pp. 377–386.

No. 779. Descriptions of New Ichneumonidæ in the Collection of the U. S. National Museum. By William H. Ashmead. Pp. 387–451.

No. 780. Description of the Yellow-Finned Trout of Twin Lakes, Colorado. By David Starr Jordan and Barton Warren Evermann. P. 453.

No. 781. Contribution toward a Monograph of the Noctuidæ of Temperate North America. Revision of some Tæniocampid Genera. By John B. Smith. Pp. 455–496.

No. 782. Catalogue of the Described Araneæ of Temperate North America. By Dr. George Marx. Pp, 497–594.

No. 783. Notes on the Serpentinous Rocks of Essex County, New York; from Aqueduct Shaft 26, New York City; and from near Easton, Pennsylvania. By George P. Merrill. Pp. 595–600.

No. 784. A Revision of the Genus Araucarioxylon of Kraus, with Compiled Descriptions and Partial Synonomy of the Species. By F. H. Knowlton. Pp. 601–617.

No. 785. Notes on North American Crayfishes, Family Astacidæ. By Walter Faxon. Pp. 619–634.

No. 786. Descriptions of Two New Species of Bats, Nyctinomus europs and N. orthotis. By Harrison Allen. Pp. 635–640.

No. 787. Scientific Results of Explorations by the U. S. Fish Commission Steamer *Albatross*. No. VIII. Description of a New Cottoid Fish from British Columbia. By Tarleton H. Bean. Pp. 641–642.

No. 788. Description of a New Lizard from Lower California. By Leonhard Stejneger. Pp. 643–644.

No. 789. Scientific Results of Explorations by the U. S. Fish Commission Steamer *Albatross*. No. IX. Catalogue of Fishes collected at Port Castries, St. Lucia, by the Steamer *Albatross*, November, 1888. By David Starr Jordan. Pp. 645–652.

These papers were published on the following dates:

Nos. 761–772 on February 5, 1890.
No. 773 on March 7, 1890.
No. 774 on March 4, 1890.
No. 775[*] on March 4, 1890.
Nos. 776–777 on March 7, 1890.
No. 778 on March 8, 1890.
No. 779 on April 21, 1890.
No. 780[†] on April 21, 1890.
No. 781 on April 19, 1890.
Nos. 782–786 on May 22, 1890.
Nos. 787[‡]–788 on July 3, 1890.
No. 789 on July 17, 1890.

*Bulletin of the U. S. National Museum.*—The Bulletin of the National Museum, the publication of which was commenced in 1875, consists of elaborate papers, frequently monographs of groups of animals, which for special reasons it is considered more desirable to publish separately than as papers in the "Proceedings."

Five bulletins have been published during the year, aggregating 1,321 octavo pages of text, with 120 figures in the text and 240 plates of illustrations.

Bulletin 34; *The Batrachia of North America*, by E. D. Cope, was issued July 6, 1889. It contains 525 pages of text, with 120 text-figures and 81 plates. This work is the result of an exhaustive study of the characters of the species of Batrachians of North America, with their variations, and has been rendered effective by the very full collections in the National Museum. A thorough discussion of the osteology of the class is presented, based on material contained in various museums in the United States and Europe. These results are expressed largely in systematic form, in the belief, as the author says, that descriptive zoölogy will never be complete until the structure is exhausted in furnishing definitions. Wherever practicable, reference is made to the relations between the extinct and living forms. Many of the manuscript descriptions used by Professor Cope in the preparation of this bulletin were written by Professor Baird and Dr. Girard many years ago, with such a publication as the present one in view. Some of the illustrations were drawn by Professor Baird.

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[*] Advance sheets issued December 10, 1889.
[†] Advance sheets issued January 20, 1890.
[‡] Advance sheets of No. 787 issued March 4, 1890

Bulletin 35; *Bibliographical Catalogue of the Described Transformations of North American Lepidoptera*, by Henry Edwards, was issued August 15, 1889, and contains 147 pages. This is an important work of reference for entomologists. The author's intention is to issue a yearly supplement to this list, keeping pace with the progress of current work. The references are in chronological order under each species.

Bulletin 36; *Contributions to the Natural History of the Cetaceans*, a Review of the Family Delphinidæ, by Frederick W. True, was issued August 8, 1889, and contains 191 pages and 47 plates. It was prepared after careful research in the principal museums of Europe where the types of Gray, Cuvier, Gervais, Schlegel, and other English, French, and Dutch naturalists were examined and measured. Some of the greatest hindrances to the study of the dolphins are the scarcity of material, the ignorance of the limits of specific variation, and the incompleteness of the descriptions of the species of Cetaceans.

Bulletin 37; *A Preliminary Catalogue of the Shell bearing Marine Mollusks and Brachiopods of the Southeastern Coast of the United States, with illustrations of many of the species*, by William Healey Dall, A. M., was issued September 12, 1889, and contains 221 pages, with 64 plates. This bulletin is intended to assist students of the Mollusca of the United States, by bringing together for their use a large number of illustrations of species belonging to the fauna of the southern and southeastern coasts of the United States, and the adjacent waters. Hitherto there has been no catalogue which covered the ground. The author has attempted to steer a middle course between overdivision of large natural groups and the conservatism which confounds unlike things together. In including or omitting groups of mollusks from this catalogue, he has been guided by convenience, rather than by systematic completeness.

Bulletin 38; *Contribution toward a Monograph of the Insects of the Lepidopterous Family Noctuidæ of Temperate North America.*—Revision of the Genus Agrotis, by John B. Smith, contains 237 pages. This was put in type during the year covered by this report, although it was not published until after the close of the fiscal year. This bulletin is the result of a study of the principal collections in the United States. Efforts have hitherto been made to divide this genus, and their exists an abundance of generic names and types, but the true characters have apparently not been recognized, and species have been erroneously associated, so that the result has been that sooner or later the proposed terms have gone into the synonomy, thus increasing the present confusion. The author has endeavored to use, as far as possible, existing generic terms in his division of the genus.

The manuscript and drawings of a bulletin relating to deep-sea fishes of the western Atlantic Ocean were transmitted to the Public Printer during the year, and the engraving of the illustrations was completed, but the text has not yet been printed. This Bulletin is by Dr. G. Brown Goode and Dr. T. H. Bean.

In a subsequent section of this report will be found a statement of the publications of the Museum during the year, and a bibliography of papers by officers of the Museum, and other investigators whose writings are based upon Museum material. The authors of these papers number 103, of whom 31 are connected with the Museum, 8 being honorary officers. The papers number 448, and are distributed under the following subjects:

| Subjects. | By Museum officers. | By other investigators. | Total. |
|---|---|---|---|
| Bibliography and biology | 6 | 2 | 8 |
| Birds and birds' eggs | 27 | 29 | 56 |
| Chemistry | 18 | 1 | 19 |
| Ethnology | 32 | 8 | 40 |
| Fishes | 37 | 30 | 67 |
| Foods and textiles | 2 | .......... | 2 |
| Geology | 30 | 4 | 34 |
| Insects | 48 | 23 | 71 |
| Mammals | 8 | 16 | 24 |
| Marine invertebrates | 5 | 2 | 7 |
| Mollusks | 19 | 4 | 23 |
| Morphology | .......... | 4 | 4 |
| Photography | 3 | .......... | 3 |
| Recent and fossil plants | 29 | 8 | 37 |
| Reptiles and batrachians | 5 | 4 | 9 |
| Miscellaneous | 42 | 2 | 44 |
| Total | 311 | 137 | 448 |

## VISITORS.

During the year the total number of visitors to the Museum building has been 274,324, and to the Smithsonian building 120,894. The greatest number of visitors in the buildings in any one day was on October 9, 1889, during the Knights' Templar Conclave, when 10,203 were registered in the Museum and 7,229 in the Smithsonian building.

The monthly register as kept by the doorkeepers is here recorded:

| Year and month. | National Museum building | Smithsonian building. |
|---|---|---|
| 1889. | | |
| July | 13,933 | 5,485 |
| August | 18,573 | 8,733 |
| September | 23,701 | 11,274 |
| October | 46,648 | 25,172 |
| November | 19,750 | 6,999 |
| December | 22,052 | 8,775 |
| 1890. | | |
| January | 18,382 | 7,541 |
| February | 23,813 | 9,105 |
| March | 23,718 | 9,699 |
| April | 27,161 | 11,612 |
| May | 21,832 | 9,283 |
| June | 14,761 | 7,216 |
| Total | 274,324 | 120,894 |
| Approximate daily average on a basis of 313 days in the year | 876 | 322 |

*Table showing the number of visitors to the Museum and Smithsonian buildings since the opening of the former in* 1881.

| Year. | Museum building. | Smithsonian building. | Total number of visitors to both buildings. |
|---|---|---|---|
| 1881 | 150,000 | .............. | 150,000 |
| 1882 | 167,455 | 152,744 | 320,199 |
| 1883 | 202,188 | 104,823 | 307,011 |
| 1884 | 195,322 | 91,130 | 286,452 |
| 1885 (January–June) | 107,365 | 60,428 | 167,793 |
| 1885–'86 | 174,225 | 88,960 | 263,185 |
| 1886–'87 | 216,562 | 98,552 | 315,114 |
| 1887–'88 | 249,665 | 102,863 | 352,528 |
| 1888–'89 | 374,843 | 149,618 | 524,461 |
| 1889–'90 | 274,324 | 120,894 | 395,218 |
| Total | 2,111,949 | 970,012 | 3,081,961 |

The Bureau of Information seems to be regarded more and more as a convenience to strangers, who are constantly applying for information and advice, not only in regard to the Museum, but as to other public buildings and the Government departments in general. This bureau has made over 30,000 connections by telephone during the year.

## LECTURES AND MEETINGS OF SOCIETIES.

In accordance with the custom of previous years, the use of the lecture hall of the National Museum has been granted for lectures and for the meetings of scientific societies.

A statement of the meetings held is here given:

The Association of American Agricultural Colleges and Experiment Stations: November 12 to 15 inclusive. Night sessions were also held on November 13 and 14.

The American Historical Association: December 28 to 31, inclusive.

The American Institute of Mining Engineers: Evening of February 18.

Memorial Meeting of the Academy of Sciences: March 27.

The Geological Society of America: April 17.

The National Academy of Sciences: April 15, 16, 17, and 18.

The National Geographic Society: Evening of May 2. The Museum lantern was used on this occasion.

Permission was granted verbally to Prof. J. J. Newberry, of the School of Mines, Columbia College, New York, for the meeting of the Committee on Arrangements of the Geological Congress, on April 18.

Permission was granted to the National Geographic Society, through its vice president, Everett Hayden, to use the lecture hall of the Museum for an illustrated lecture by Ensign J. B. Bernadou, U. S. Navy, on the evening of April 11.

The course of Saturday lectures for 1890 consisted of two series, the programme of each being as follows:

### FIRST SERIES.

*February* 1.—Prof. John M. Coulter: The Physical Basis of Life.

*February* 8.—Prof. W. O. Atwater: Food and Health.

*February* 15.—Prof. Henry C. Adams: An Interpretation of the Social Movement of Our Times.

*February* 22.—Capt. C. E. Dutton: The Future of the Far West.

*February* 27.—Prof. H. Carrington Bolton: Four Weeks in the Wilderness of Sinai.

### SECOND SERIES.

*March* 8.—Prof. C. R. Van Hise: Deposits of Iron Ore in Northwestern States.

*March* 13.—Hon. W. T. Harris: A Study of Two Pictures of Raphael and One of Holbein.

*March* 20.—Dr. Tarleton H. Bean: The Salmon of Alaska.

*March* 29.—Prof. T. C. Mendenhall: Chance and the Long Run.

*April* 3.—Mr. Edward Burgess: Yachts and Yachting.

This course was delivered under the direction of the Joint Committee of the scientific societies of Washington.

*Table showing the number and dates of Saturday lectures since* 1882.

| Year. | Date of first and last lecture. | No. of lectures. |
|---|---|---|
| 1882 | March 11, April 29 | 8 |
| 1883 | January 13, March 31 | 12 |
| 1884 | January 5, April 26 | 17 |
| 1885 | February 7, May 2 | 12 |
| 1886 | March 6, May 8 | 10 |
| 1887 | March 12, May 7 | 12 |
| 1888 | February 18, May 5 | 12 |
| 1889 | March 9, May 11 | 10 |
| 1890 | February 1, April 3 | 10 |
| Total |  | 103 |

A course of four lectures on the anthropological exhibits at the Paris Exposition of 1889, was given by Mr. Thomas Wilson. The subjects of his lectures were:

*Tuesday, May* 13.—Prehistoric Anthropology.
*Friday, May* 16.—Ancient Industries, Charms and Amulets.
*Wednesday, May* 21.—History of Human Habitations.
*Friday, May* 23.—Anthropological Congresses and Prehistoric Museums.

The meetings of the Biological Society of Washington have been held during the past year at the assembly hall of the Cosmos Club, this location being found more convenient than the National Museum.

The use of the Museum lantern has been granted on several occasions for the purpose of illustrating lectures, both in the Museum building and elsewhere. This was done without charge, excepting for the actual cost of the gas. The services of an assistant were also given by the Museum free of charge.

## STUDENTS.

Previous to the organization of the staff of curators in the National Museum, it was customary to send collections to all parts of the United States, and, in some instances, to foreign countries, to be worked up by specialists. This system was then necessary, owing to the fact that there were few specialists in Washington. During the last ten years the policy of the Museum in this respect has been modified, owing to the presence in the Museum of a trained staff among whom the collections are now usually assigned for study.

Requests are occasionally made by students for material to be used for comparison in connection with their special studies, and such requests are always granted when it can be done without detriment to the Museum.

During the year several lots of birds' skins have been lent to Dr. J. A. Allen, of the American Museum of Natural History. The Museum collection of bats has been placed at the disposal of Dr. Harrison Allen, of Philadelphia, who is engaged in the preparation of a new edition of his monograph of the bats of North America. At the request of Mr. Ernest E. Thompson, of Toronto, Canada, skins of birds and skins and skulls of rodents have been sent to him for study. Dr. C. Hart Merriam, of the Department of Agriculture, has made extensive use of the reserve series of North American mammals. Dr. E. A. Mearns, of Fort Snelling, Minnesota, has examined the collection of prairie dogs. Dr. D. W. Prentiss, of Washington, has had occasion to make a study of the ermine skins in the collection. Specimens of *Doras dentatus* and *Clarias nieuhofii* were lent for study to Mr. Bashford Dean, of the College of the City of New York. A number of Coleoptera were sent to Capt. T. L. Casey for study. The Museum collection of Crustacea from the Bahamas was sent to Prof. C. S. Dolley, of the University of Pennsylvania, for study. Twelve specimens of the ocean-bottom, collected by the U. S. Fish Commission steamer *Albatross* and the U. S. S. *Dolphin*, were sent to Rev. Albert Mann, jr., of Newark, New Jersey, for study.

Dr. G. Baur, of Clarke University, studied the collection of North American Chelonians in the Museum. Mr. James E. Benedict has begun the study of the collection of Brachyura from the North Pacific Ocean. Dr. R. W. Shufeldt was granted permission to study birds' skeletons. The Department of Birds has granted free access to its collections to many authors, whose works are referred to in the Bibliography (section IV).

Mr. A. B. Farnham, of Benning's, District of Columbia, is acting as a volunteer assistant in the department of taxidermy, and Mr. Leigh W. Reed has been doing similar work in the Department of Geology.

Mr. John B. Daish has received instruction in photography and taxidermy.

## FINANCE, PROPERTY, SUPPLIES, AND ACCOUNTS.

The statements relating to these branches of the administrative work have been prepared by Mr. W. V. Cox, chief clerk.

The appropriations received by the Museum for the fiscal year ending June 30, 1890, are as follows: For preservation of collections, $140,000; for furniture and fixtures, $30,000; for heating and lighting, $12,000.

### PRESERVATION OF COLLECTIONS.

Appropriation by Congress for the fiscal year ending June 30, 1890, for the preservation, exhibition, and increase of the collections from the surveying and exploring expeditions of the Government, and from other sources, including salaries or compensation of all necessary employés, $140,000 (sundry civil act, March 2, 1889, public No. 154, page 16).

Out of this appropriation $118,378.99 has been expended for salaries or compensation; $4,952.67 for supplies; $2,307.60 for stationery; $5,141.48 for specimens; $1,307.61 for books and periodicals; $1,645.97 for travel; and $2,416.92 for freight and cartage, making a total expenditure of $136,151.24 and leaving a balance of $3,848.76 on hand July 1 to meet outstanding liabilities.

Following is a detailed statement of the salaries or compensation paid from the appropriation for preservation of collections during the present year.

The scientific staff consists of the Assistant Secretary, Smithsonian, in charge U. S. National Museum, at a monthly salary of $333.33; three curators at $200 each, three at $175, two at $150, one at $125, and one at $100; one acting curator at $150, two assistant curators at $133.33 each, one at $125, and two at $100; one agent at $100, one collector and two aids at $80 each, two aids at $75 each, one at $65, one at $60, two at $55, and one at $50, making a total paid to the scientific staff of $31,512.93.

The clerical staff is as follows: the chief clerk at a monthly salary of $175, chief of Correspondence and Reports at $158.33, the registrar at $158.33, disbursing clerk at $100, one draftsman at $83.33, one assistant draftsman at $40, one clerk at $125, two at $115, two at $100, two at $90, one at $83.33, two at $75, two at $70, four at $60, three at $55, and four at $50; there are also one stenographer at $100, one typewriter at $50, one copyist at $55, four at $50, one at $45, seven at $40, three at $35, and two at $30, making a total paid to the clerical staff of $34,514.29.

The following preparators were employed this year: One colorist at $110, one photographer at $158.33, one taxidermist at $125, one at $115, one at $80, four assistant taxidermists at $60 each, one preparator at $100, two at $80, one at $75, one at $60, and one at $4 per day, making the total paid to this branch of the service $14,367.96.

In the Department of Buildings and Labor one superintendent was employed at a salary of $137.50; one assistant superintendent at $90; one watchman at $65, two at $60, twelve at $50, and three at $45 each; one skilled laborer at $70, two at $50 each, and one at $2 per day; three laborers at $45, four at $40, and thirteen at $1.50 per day; two attendants at $40, and five cleaners at $30 each; two messengers at $45, four at $25, two at $20, and one at $1.25 per day, making a total of $29,690.71.

All of these persons were employed by the month or day, and several for part of the year only.

The following amounts have been expended from this appropriation for temporary help during the year: On the scientific staff, $225.81; on the clerical staff, $658.96; for preparators, $354.45; and for laborers, $1,717.24—a total of $2,956.46.

In addition to the foregoing amounts, $1,336.68 has been expended for special contract work, making a total of $118,378.99 paid out during the year for salaries and compensation on account of preservation of collections.

### FURNITURE AND FIXTURES.

Appropriation by Congress for the fiscal year ending June 30, 1890, for cases, furniture, fixtures, and appliances required for the exhibition and safe keeping of the collections of the National Museum, including salaries or compensation of all necessary employés, $30,000. (Sundry civil act, March 2, 1889. Public, No. 154, p. 16).

Out of this appropriation $15,926.21 has been expended for services. Following is a detailed statement of the salaries or compensation paid during the year:

One engineer of property was employed at a salary of $150 per month; one clerk at $75, and one copyist at $55; one foreman of carpenters at

$91 per month; one cabinet-maker and six carpenters at $3 per day each; one painter at $65 per month, and one at $2 per day; three laborers at $50, and two at $45 per month; two at $2 per day, and two at $1.50; making an expenditure of $14,125.14 for salaries and wages.

The following extra temporary help has been employed during the year: One clerk at $50 per month; four carpenters at $3 per day; one laborer at $2, and six at $1.50 per day; one laborer and two cleaners at $30 per month each, making an expenditure of $1,803.07 for extra employés, and a total of $15,926.21 for services.

$4,423.77 has been expended from this appropriation for exhibition cases, with designs and drawings for the same, as given in detailed list below:

| | |
|---|---|
| 1 mahogany case for moose group, special form | $662.75 |
| 1 mahogany case for musk-ox group, special form | 490.00 |
| 1 mahogany case for antelope group, special form | 316.00 |
| 1 mahogany case for Viking ship, special form | 103.00 |
| 1 ebonized pedestal and glass case for Bryant vase, special form | 395.00 |
| 1 walnut case for humming birds, special form | 16.82 |
| 5 double-width, upright, mahogany table cases | 478.50 |
| 5 double-width, upright, mahogany table cases | 451.00 |
| 8 pairs mahogany bases | 720.00 |
| 8 mahogany top cases | 280.00 |
| 1 pair mahogany bases for Liverpool case | 170.00 |
| 1 mahogany top and set of carved panels for Liverpool case | 54.00 |
| 1 flat-top mahogany table case | 47.00 |
| 7 slide-screen cases, altered | 182.70 |
| Designs and drawings for cases | 57.00 |
| Drawers, trays, boxes, etc | 931.48 |
| Frames, stands, miscellaneous wood work | 158.84 |
| Office furniture, chairs for exhibition halls, etc | 656.19 |
| Lumber | 1,276.88 |
| Apparatus, containers for alcoholic specimens, supplies, etc., have been bought as follows: | |
| Apparatus | 605.50 |
| Glass jars, containers for specimens, etc | 395.45 |
| Hardware and interior fittings for cases | 1,291.07 |
| Cloth, cotton, etc. (linings for cases) | 85.97 |
| Iron brackets and racks | 130.00 |
| Tools | 107.37 |
| Glass | 1,875.38 |
| Paints, oils, brushes | 681.68 |
| Tin, lead, etc | 90.98 |
| Brick and plaster work | 98.00 |
| Rubber-tubing, hose, etc | 40.87 |
| Traveling expenses | 31.95 |

*List of cases built or remodeled during the year by carpenters employed on the Museum force.*

CASES CONSTRUCTED.

3 bookcases, 2 sections each, for library.
2 bookcases, 1 section each, for library.
8 pine unit storage cases, south tower.
1 special mahogany case, for foraminifera.
1 sliding table case.
1 pine sample case for unit boxes.
3 card catalogue cases.
1 special case around stone slab.

CASES RECONSTRUCTED OR REMODELED.

23 special cases in bird hall, remodeled and extended.
17 cases rendered insect-proof by lining them with metal and fitting doors with rubber tubing.
1 large cherry case reconstructed, made into 3 cases.
2 mahogany floor cases remodeled.
1 mahogany one-half unit case remodeled.
1 mahogany pier case reconstructed.
18 Liverpool cases, remodeled and completed.
3 sloping cases furnished with panels.

Although the work and purchases on account of furniture and fixtures have been somewhat restricted this year by the lessened appropriation, the plans and methods heretofore adopted have been carried out as far as possible.

Considerable exterior work has been done. Frequent repairs have been required in the roofs of both buildings; the north front of the natural-history laboratory has been reconstructed; flagging has been laid from the main pavement to the door of the animal house, and the window ledges of nearly the entire museum have been tinned.

In the interior many repairs and changes have been found necessary to the building itself, as well as to the cases and other furniture.

The hall, northwest pavilion, has been wainscoted in oak, and a second much-needed staircase has been built; self-closing, sound-deadening doors, which divide this hall from the lecture room, have been made and put in place; raised floors have been constructed in the office of the engineer of property, and in the stationery room, and the wooden flooring throughout the building has been frequently patched.

Several standard, special and sample cases have been built and many more remodeled and extended. The floor of the large special case for the Moose group has been reconstructed; many cases have been repaired, fitted with panels, shelving, racks, brackets, etc., relined, ebonized, polished, glazed, furnished with doors and locks, and otherwise completed.

More than 130 mahogany, oak, and pine frames have been made, some of them of great size, like the frame for the allegorical tile-panel of "Progress" now placed over the north entrance.

Several bases and pedestals, and nearly 5,000 blocks for the display of specimens have been made and completed; screens have been constructed, and more than 900 trays, and many shelves and diaphragms have been made and fitted; several tables have been built, and over 70 wing-frames have been repaired, rehinged, and rehung.

Several pairs of mahogany doors have been made for cases, and the time of the carpenters has been taken up to a considerable extent in refitting the doors of other cases; they have also been required to make a large number of boxes for the storage of specimens, and for the shipment of those designed for exchanges. In fact the general miscellaneous work demanded of them throughout the year has been so extensive as to consume much time, and required a great deal of labor.

Considerable metal work of various kinds has been done; cases have been made insect proof by being lined with metal, and metal partitions have been made for file-holders; about 40 copper and tin tanks for alcoholic specimens have been made, and more than that number completed, besides many cans for collecting purposes; nearly 1,500 brass and tin label-holders have been made.

In addition to the locksmith's work required on new and reconstructed cases, the combination locks, suited to the symbol of each department, have been changed on many of the unit tables in the Museum. This work has been done in great part by a fireman skilled in such matters, at periods when he could be spared from his regular duties in the engine and boiler-rooms.

## HEATING, LIGHTING, ELECTRIC AND TELEPHONIC SERVICE.

Appropriation by Congress for the fiscal year ending June 30, 1890, for expenses of heating and lighting and electrical and telephonic service for the National Museum, $12,000. (Sundry civil act, March 2, 1889, Public No. 154, p. 16.)

Out of this appropriation $5,114.87 has been expended for salaries or compensation; $2,058.26 for fuel; $1,113.82 for gas; $601.05 for telephones; $264.49 for electrical work and supplies; $100 for rental of call-boxes; $269.25 for heating repairs; $147.86 for heating and lighting supplies; and $3.25 for travel, making a total of expenditures to July 1, 1890, of $9,672.85, and leaving a balance of $2,327.15 to meet outstanding liabilities.

Following is an analysis of salaries or compensation paid from the appropriation for heating and lighting during this year:

One engineer was employed, for part of the year only, at a salary of $120 a month;* five firemen at $50 each, and one at $40 a month; one telephone clerk at $60, and one at $35 a month; $137.74 has been expended for extra labor, making the total expenditure for services in this department $5,114.87.

During the winter the engineer reported some of the boilers as being in a very bad condition, the tubes which have been in use many years being so warped, burnt, and corroded as to be liable to give out at any time; he also named 6 pounds as the limit of steam pressure safe under the circumstances, and suggested that the fires be kept up night and day, as the only method by which the necessary temperature could be maintained. This suggestion was accordingly carried out. It will, however, undoubtedly be necessary to take some action in regard to heating repairs and changes in the near future.

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* The death of Mr. A. A. Duly, for ten years engineer, occurred in March.

In several instances it has been found advisable to change the positions of the radiators, and to make new connections. This work, and all repairs to machinery, gas-fitting, plumbing, and the needed blacksmith's work, have been accomplished by men employed on the regular Museum force.

In prosecuting the general routine of Museum work, bids have been advertised for and proposals invited, as in past years, but the list of articles to be purchased has been shortened considerably, it having been found that the requirements of the Museum are so varied that, excepting for articles of general use, it is impossible to anticipate the wants for the entire year.

As a result of the growth and needs of the Museum, it has been found advisable, from time to time, to reconstruct many cases of the types purchased in earlier years, and to make an inventory of cases and furniture in the Museum, based upon new standards and nomenclature. This work, as mentioned in a former report, was begun two years since, under the direction of Mr. J. E. Watkins, the engineer of property.

In making this inventory, every piece of furniture in the Museum has been inspected; the old numbers have been noted, and small brass plates with the new numbers stamped on them have been attached to more than 4,500 cases, bases, pedestals, stands, etc., and to the numerous articles of office furniture.

When an article is condemned, or, by being incorporated with another, loses its identity, the original number is noted in the office of the engineer of property, and such record made that the history of each article can be traced at any time without difficulty.

With a view to simplifying the method of keeping account of services, in January of this year a system of time-books was adopted, in which the record of attendance is kept by the head of each department for himself, and for all employés under his direction.

These books give the name and designation of each person, the rate of compensation, furnish an accurate record of attendance in each case, and state the cause of any absence, so far as necessary to decide whether such is to be counted against annual leave, excused on account of illness, or charged against the individual and deducted from the monthly compensation.

These time-books, after being certified to by the head of each department, are examined by the chief clerk of the Museum, and if found correct are signed by him and forwarded to the disbursing clerk, who uses them as a basis in preparing the pay-rolls.

This method not only simplifies the work in taking careful note of the attendance, but is found advantageous from the facility with which each individual record can be referred to,

### ROUTINE.

In the office of the chief clerk 1,451 orders for supplies have been sent out during the year, over 1,000 letters have been written, 550 circular letters and 265 proposals for supplies have been sent out, and 1,051 vouchers have been passed upon and paid.

This work, which can be set down in numbers, is but a small part of the labor which devolves upon this office, and upon the prompt and accurate accomplishment of which the efficiency of the scientific branches of Museum work largely depends. The force, which consists of two clerks and one copyist, are so hard pressed that it has been this year, as usual, a question if all would be able to take more than a fraction of the annual leave which is accorded to employés in the Museum.

### CORRESPONDENCE AND REPORTS.

In the report for 1889 the work of this department was referred to at some length in order to indicate, to those who might be interested, the methods of administration which had been adopted in it, and the scope of the work assigned to it. There has been no material change in either during the year.

Mr. R. I. Geare, chief of the division of correspondence and reports, has rendered important aid in this work. The clerical force of the office has been increased, and now consists of three stenographers, two typewriters, an index clerk, and a messenger.

During the year about 7,000 official papers have been prepared for the signature of the Secretary and the Assistant Secretary.

The following geographical statement of letters written in reply to requests for information upon various subjects, may be of interest as showing the amount of correspondence of this kind carried on in different parts of the United States and in other countries.

| Locality. | No. of letters written. | Locality. | No. of letters written. |
|---|---|---|---|
| Alabama | 27 | Indiana | 72 |
| Arizona | 41 | Iowa | 68 |
| Arkansas | 26 | Kansas | 51 |
| California | 64 | Kentucky | 34 |
| Colorado | 31 | Louisiana | 25 |
| Connecticut | 59 | Maine | 63 |
| Dakota | 11 | Maryland | 133 |
| Delaware | 5 | Massachusetts | 209 |
| District of Columbia | 1,478 | Michigan | 52 |
| Florida | 79 | Minnesota | 29 |
| Georgia | 12 | Mississippi | 16 |
| Idaho | 6 | Missouri | 45 |
| Illinois | 125 | Montana | 24 |
| Indian Territory | 7 | Nebraska | 24 |

| Locality. | No. of letters written. | Locality. | No. of letters written. |
|---|---|---|---|
| Nevada | 5 | Canada | 25 |
| New Hampshire | 19 | Central America | 3 |
| New Jersey | 89 | Costa Rica | 2 |
| New Mexico | 18 | Cuba | 3 |
| New York | 456 | England | 23 |
| North Carolina | 30 | France | 28 |
| Ohio | 119 | Germany | 20 |
| Oklahoma | 2 | Greece | 1 |
| Oregon | 18 | Hungary | 1 |
| Pennsylvania | 247 | Iceland | 4 |
| Rhode Island | 23 | Italy | 2 |
| South Carolina | 29 | Japan | 6 |
| South Dakota | 19 | Mexico | 12 |
| Tennessee | 76 | New Brunswick | 1 |
| Texas | 79 | Nicaragua | 2 |
| Utah | 6 | Newfoundland | 1 |
| Vermont | 19 | New Zealand | 1 |
| Virginia | 118 | Nova Scotia | 1 |
| Washington | 10 | Prussia | 2 |
| West Virginia | 19 | Russia | 9 |
| Wisconsin | 40 | Scotland | 9 |
| Wyoming | 8 | South America | 2 |
| Africa | 4 | Sicily | 1 |
| Alaska | 8 | Turkey | 1 |
| Australia | 5 | West Indies | 11 |
| Bermuda | 2 | Total | 4,475 |
| British Columbia | 4 | | |

A special feature of the work of this department consists of the preparation of reports upon material submitted for examination, based upon the official reports of the curators acknowledgments of specimens received as gifts, loans, and deposits are prepared in this office.

During the year 314 lots of specimens (483–796 inclusive) for examination and report have been received. The following statement shows the geographical sources of this material:

| Source. | Number of lot. | Total. |
|---|---|---|
| North America: | | |
| British America | 589, 715 | 2 |
| Central America | 690 | 1 |
| Mexico | 497, 498, 517, 519, 681, 646 | 6 |
| United States: | | |
| Alabama | 518, 557, 643, 759, 787 | 5 |
| Arizona | 584, 631, 720, 743, 773 | 5 |
| Arkansas | 490, 604, 664, 780 | 4 |
| California | 491, 514, 550, 588, 603, 638, 655, 706, 746, 756, 786, 793, 796 | 13 |
| Colorado | 543, 593, 646, 657, 662, 682, 776 | 7 |
| District of Columbia | 485, 537, 724, 725, 739, 762, 763 | 7 |
| Florida | 525, 565, 572, 580, 585, 595, 605, 609, 650, 654, 668, 670, 687, 719, 729, 738, 741, 785, 791. | 19 |

| Source. | Number of lot. | Total. |
|---|---|---|
| United States—Continued. | | |
| Georgia | 637, 765 | 2 |
| Illinois | 521, 531, 620, 686, 702, 721, 781, 795 | 8 |
| Indiana | 512, 633, 708 | 3 |
| Indian Territory | 511 | 1 |
| Iowa | 568, 701, 705, 764, 774, 790 | 6 |
| Kansas | 506, 583, 641, 700, 710, 732, 748, 770 | 8 |
| Kentucky | 538, 541, 549, 560 | 4 |
| Louisiana | 641, 656 | 2 |
| Maine | 576, 602, 642, 685, 777 | 5 |
| Massachusetts | 494, 500, 606, 660, 661, 695 | 6 |
| Maryland | 546, 561, 612, 680, 745, 753, 779 | 7 |
| Minnesota | 503, 624 | 2 |
| Mississippi | 704, 736 | 2 |
| Missouri | 513, 526, 533, 539, 540, 562, 582, 607, 684, 690, 691, 742 | 12 |
| Montana | 450, 477, 554, 596, 672, 692, 711, 733, 749, 775, 789 | 11 |
| Nevada | 486, 755 | 2 |
| New Hampshire | 532 | 1 |
| New Jersey | 579 | 1 |
| New Mexico | 698, 713 | 2 |
| New York | 486, 493, 502, 520, 522, 536, 550, 590, 597, 601, 628, 666, 674, 757, 794 | 15 |
| North Carolina | 488, 564, 570, 639, 703, 709, 736, 758, 761 | 9 |
| North Dakota | 771 | 1 |
| Ohio | 508, 647, 651, 718, 728 | 5 |
| Oregon | 545 | 1 |
| Pennsylvania | 512, 558, 567, 578, 581, 599, 648, 760, 778 | 9 |
| South Carolina | 499, 553, 587, 610, 673, 675, 736 | 7 |
| South Dakota | 510, 516, 707, 722, 730, 740, 772 | 7 |
| Tennessee | 489, 527, 563, 577, 613, 615, 617, 622, 623, 625, 630, 644, 652, 659, 665, 667, 669, 726, 734, 768 | 20 |
| Texas | 483, 492, 501, 518, 524, 530, 556, 653, 658, 694, 697 | 11 |
| Utah | 507, 528, 634, 679 | 4 |
| Vermont | 505, 509 | 2 |
| Virginia | 495, 523, 534, 535, 544, 571, 573, 574, 575, 592, 618, 619, 635, 677, 678, 679, 693, 712, 714, 716, 730, 737, 751, 754, 767, 769, 788 | 27 |
| Washington | 529, 552, 569, 594, 744, 747 | 6 |
| West Virginia | 487, 515, 547, 566, 626, 640, 683, 688, 750 | 9 |
| Wisconsin | 551, 555, 629, 632, 645, 663 | 6 |
| Wyoming | 484, 608 | 2 |
| Europe: | | |
| England | 627 | 1 |
| Spain | 504 | 1 |
| Sweden | 621 | 1 |
| Asia: | | |
| Japan | 676 | 1 |
| Oceanica (Polynesia): | | |
| Sandwich Islands | 600, 723 | 2 |
| Pacific Ocean: | | |
| Easter Island | 616 | 1 |
| Locality not determined | 591, 649 | 2 |

In March, 1890, the office was furnished with a graphophone, which has been found exceedingly useful.

## PREPARATION OF LABELS.

Three thousand nine hundred and twenty forms of labels have been printed during the year, as shown in the following table:

| Department. | No. of forms. | Department. | No. of forms. |
|---|---|---|---|
| Materia medica | 1, 309 | Comparative anatomy | 104 |
| Geology | 1, 328 | Graphic arts | 79 |
| Foods and textiles | 542 | Mammals | 76 |
| Ethnology | 246 | Total | 3, 920 |
| Oriental antiquities | 156 | | |
| Porcelain collection | 120 | | |

## BUILDINGS AND LABOR—POLICE AND PUBLIC COMFORT.

The staff employed for police and protection has remained under the charge of Henry Horan, superintendent of buildings. It consists of watchmen, painters, carpenters, skilled laborers, laborers, cleaners, and attendants.

The number of watchmen is usually sixteen. They are divided into watches, by whom the Smithsonian and Museum buildings, and the collections stored and exhibited therein, are guarded day and night.

Eight or nine carpenters are generally employed, and are kept busy continually in constructing cases and shelves, making frames for labels, remodeling old forms of cases, putting locks on cases, making repairs in the buildings, etc.

The force of skilled laborers is, as a rule, nine or ten in number. Their time is occupied in painting blocks for the exhibition of specimens, painting trays, easing trays, fitting shelves, adjusting panes of glass in cases and windows, and assisting the carpenters and painters in many ways.

There are only two painters constantly on the Museum roll. These, with the assistance of some of the skilled laborers, perform all the work of this kind required in the Museum, including the repainting of walls and ceilings of rooms, staining pedestals for groups of specimens and cases, painting book-cases, shelving, blocks for exhibition purposes, etc.

The force of laborers consists of about twenty-four men. They are kept continually busy moving specimens, arranging cases, attending to the cleaning of offices, and washing the floors in the exhibition halls.

The number of cleaners and attendants averages about eight. They are constantly occupied in cleaning glass, dusting cases, of which there are now more than 1,700, and sweeping. They are also expected to answer, as far as practicable, the questions of visitors.

The telephonic and telegraphic service of the Museum is under the supervision of the superintendent of buildings.

From the reports of the superintendent are quoted the following statements, which will serve to show in part the character of the work accomplished by the laboring force during the year:

## 1889.

*July.*—The steam pipes under the south hall were covered with magnesia covering. A raised platform was put in the office of the engineer of property. One extra radiator was placed in the stationery room and also in the property clerk's office. A raised floor was added to the stationery room. The mechanics were engaged during the month in painting 572 blocks, easing 106 trays, painting 299 trays, making and fitting 34 shelves, and putting in 82 lights of glass. Besides this work, a great deal of miscellaneous jobs, covering 49 orders, was executed.

*August.*—Double-acting base doors were hung at the entrance to the northwest pavilion. A sewer pipe was put in the animal house. The north side of the natural-history laboratory building was bricked up, and a new roof put on. The hollow brick partition was removed from the second floor of the northwest pavilion. A private stairway was built, leading from the first to the second floor of the Assistant Secretary's apartments. The mechanics were kept busy fitting 13 shelves, painting 675 blocks, easing 221 trays, altering 95 locks, and putting in 75 lights of glass. In addition to this, 55 miscellaneous orders were filled.

*September.*—New frames, jams, etc., were made for the large doors at the west entrance. Two wire screens were made and put up in arches on the west balcony. New storm doors were made and placed at the north entrance of the Smithsonian building. The mechanics were employed in fitting 281 trays, painting and ebonizing 64 blocks, repairing and altering 117 locks, putting in 173 lights of glass. In addition to this work, 69 miscellaneous orders were filled.

*October.*—The mechanics were kept busy altering locks, making 259 blocks, painting 723 blocks, putting in 179 lights of glass, and glazing cases. Numerous matters of smaller importance were attended to.

*November.*—Radiators were put in and steam heat substituted for the stove in the label department on the north balcony. During this month the mechanics were employed in ebonizing 146 blocks, altering and repairing 89 locks, putting in 130 lights of glass, making keys, and easing trays. In addition to this, 33 miscellaneous matters were completed.

*December.*—Steam pipes were attached from the basement to the third floor of the northwest pavilion, and an extra radiator put in. The mechanics were employed in easing 233 trays, ebonizing 374 blocks, making 25 blocks, tinning 102 sills and ledges, putting in 159 lights of glass, making keys, and repairing locks. Besides this work, 46 miscellaneous requisitions for work were attended to.

## 1890.

*January.*—The laborers were employed in removing cases, and cleaning and scouring the lecture hall for the course of "Saturday lectures" given under the auspices of the scientific societies of Washington. Gas pipes were run along the ceiling in the northwest and southwest ranges, and fixtures attached. The north, south, east, and west halls, and the east-north and east-south ranges and northwest court were lighted by electricity.

*February.*—A heavy sarcophagus was removed from the west hall to the rotunda. Water and gas connections were introduced into the paint shop. The cases in the east and west halls were rearranged, necessitating the services of the greater part of the laboring force.

*March.*—The floor was painted in the gentlemen's lavatory. Nine double Liverpool cases were set up in the main hall of the Smithsonian building for the use of the Department of Mollusks. The front of a Haida house was removed from the Smithsonian building to the Museum, and hung on a pier on the south side of the west hall.

*April.*—A new window was constructed on the third floor of the northwest pavilion. All locks not working by the regular master key were removed and replaced by the standard lock. A break in one of the water-pipes of the Smithsonian building was repaired.

*May.*—The trenches and basements in both buildings were whitewashed. The windows were fitted, where necessary, with new awnings. Numerous miscellaneous jobs were completed by the mechanics.

*June.*—The office room on the east side of the north gallery was cleaned and painted. The room on the south side of the east balcony was prepared for occupation. The water and gas-pipes, roofs and gutters were examined and repaired. The heating apparatus, electric clocks, watch signal station, telephone batteries, etc., were inspected. A duplex water filter was placed in the gentlemen's public comfort room.

## THE WORK OF THE MUSEUM PREPARATORS.

### TAXIDERMISTS AND MODELERS.

*Taxidermy.*—The construction of additional groups of important species of North American mammals has been the chief work of the year. The largest group finished was that of the Moose, which comprises six individuals of both sexes and of different ages. This group is somewhat larger than that of the Bison, which was completed last year, and is, indeed, the largest group thus far exhibited. It is in most respects quite as satisfactory as the Bison group, and perhaps more striking. The work was planned by Mr. Hornaday, and executed by Mr. Joseph Palmer and Mr. A. H. Forney. Three specimens of the Musk-ox were removed from the wall-case and brought together to form a group. They were considered sufficiently valuable to merit a more prominent place than they had previously occupied. One of the specimens was partially remounted.

A number of additional groups of mammals were nearly or quite completed during the year, but have not yet been placed on exhibition. The taxidermists mounted in all 32 mammals during the year, including the large forms previously mentioned. In addition, 24 mammals were skinned and 50 dry skins made up. Casts were made of certain of the specimens received in a fresh condition, to be used as aids in mounting the skins. As in former years, a large amount of miscellaneous work, such as cleaning greasy specimens, overhauling duplicate wet skins, repairing mounted specimens, preparing preservatives, etc., was performed. This necessary work consumes a great deal of time, but produces no direct effect in increasing the exhibition series.

The modeler performed various tasks for the Anthropological Department of the Museum, such as making casts of stone implements, inscriptions, bas-reliefs, etc. He also made casts of a number of fishes and of some porpoise-heads, the molds of which had been in the Museum for some time.

At the close of the year the Museum lost the valuable services of Mr. W. T. Hornaday, who resigned his position as Chief Taxidermist.

In April Mr. William Palmer was instructed to proceed to the Pribylov Islands, Alaska, to hunt walrus for the Museum. He was still absent at the end of the year covered by this report.

### OSTEOLOGIST.

Mr. F. A. Lucas, Osteologist, states that, as in preceding years, the care of material already in the collections has demanded much time and attention. Owing to insufficient room, frequent changes have been made necessary in the arrangement of the study series.

The placing of casters on the storage bases in the osteological hall necessitated moving the greater portion of the study series, as well as all the smaller mounted specimens in the exhibition series.

The preparation of much needed card-catalogues of ligamentary skeletons, of alcoholic birds, and embryos has been continued, and this important work is now nearly completed, as is also the changing of jars and renewing the alcohol in which the specimens are contained.

In addition to the osteological work summarized in the subjoined table a series of vertebræ of Rhytina has been modeled to complete a specimen for the Museum of Comparative Zoölogy, some work done on the synoptic series of invertebrates, and 76 specimens of vertebrate fossils cleaned, repaired, and mounted. In addition, the skeleton of Irish elk and cast of *Phenacodus* have been repaired and the cast of *Dinoceras* skeleton remounted.

The skill of Mr. Scollick has been shown equally in the preparation of vertebrate fossils and of osteological material, and during a great portion of the year he has been the only assistant in this department of preparatory work, although the preparation of osteological specimens, vertebrate fossils, and invertebrates now devolves upon this department.

The number of skulls of small mammals cleaned is omitted from the following table, although included in the report of work for 1888–'89.

*Summary of osteological work for* 1889–'90.

| | Mammals. | Birds. | Reptiles. | Amphibia. | Fishes. | Total. |
|---|---|---|---|---|---|---|
| Received in the flesh: | | | | | | |
| Entire skeletons | 12 | 50 | 1 | ........ | 1 | 64 |
| Incomplete skeleton | ........ | 1 | ........ | ........ | ........ | 1 |
| Cleaned: | | | | | | |
| Entire skeletons | 10 | 31 | 1 | 2 | ........ | 44 |
| Skulls | 22 | 4 | 2 | ........ | 2 | 30 |
| Incomplete skeletons | 17 | 3 | 2 | ........ | ........ | 22 |
| Mounted: | | | | | | |
| Entire skeletons | 3 | 15 | 1 | 6 | ........ | 25 |
| Skulls | 4 | ........ | ........ | ........ | ........ | 4 |
| Limbs, etc | 33 | 1 | 1 | ........ | 2 | 37 |
| Total | 101 | 105 | 8 | 8 | 5 | 227 |

*Collection of domestic animals.*—The work of mounting typical specimens of domestic animals was begun in September, 1889. At the close of the year covered by this report 54 specimens had been secured.

Mr. Nelson R. Wood was directed to attend the American poultry show of January, 1890, held in New York City, for the purpose of obtaining specimens for the Museum. As a result of this visit many fine specimens have since been contributed from various sources, including some winners of first prizes.

The following is a list of the different varieties which have been mounted for exhibition in the National Museum:

### DOMESTIC FOWLS.

Light Brahma cock and hen.
Partridge Cochin hen.*
Langshan chick.
Barred Plymouth Rock hen.*
Silver Wyandotte hen.*
Jersey Blue chick.
Indian Game hen.*
Indian Game hen.
Eureka Game cock.
Sumatra Game cock.
Sumatra Game chick.
Pit Game cock.
Muffed, Pit Game, two chicks.
White-crested, Black Polish hen.
White-crested, White Polish hen.
Single-comb, White Leghorn.
Blue Andalusian.
Silver-spangled Hamburgh hen and chick.
Silver Sebright Bantam, three specimens.
Black-breasted, Red Game Bantam, cock and hen.
Rose-comb, Black African Bantam, hen and two chicks.

### PIGEONS.

Blue Carrior.
Dun Carrier.
Short faced, Bald-head, Black Tumbler.
Red-checkered Homer.
Blue-checkered Homer.
Blue-rock Homer.
English Fantail.
Scotch Fantail.
Black Trumpeter.
Full-head, Black-barred, Blue-winged Swallow.
Plain-head, White-barred, Red-winged Swallow.
White-barred, Blue-winged Fairy.
Full-head, Blue-winged Swallow.
Plain-head, White-barred, Blue-winged Swallow.
Black Magpie.
Archangel (three ♂, ♀).
Spangled Ice Pigeon, two specimens.
Isabel, Pigmy Pouter.
Common Dove-house Pigeon, five specimens.

## COLORIST.

Mr. A. Zeno Shindler has, during the year, devoted the principal portion of his time in preparing for the Department of Ethnology a collection of paintings illustrating the races of men. Among them are the following: Apache Indians, Eskimo, Chinese, Japanese, Aino, Thibetan, Hindoo, Akka, Zulu, Fiji Islander, Dyak of Borneo, Native of Madagascar. A number of Indian photographs, and a life-size model and painting of natives of Samoa have been made.

## PHOTOGRAPHER.

During the year Mr. T. W. Smillie has made 357 negatives. Of these 98 were for the Department of Ethnology, 28 for the Department of Mammals, 9 for the Department of Comparative Anatomy, 41 for the Department of Geology, 5 for the Section of Graphic Arts, 176 miscellaneous prints, and 110 transparencies.

The number of prints made during the year is 3,972, distributed as follows:

| | |
|---|---|
| For the Department of Ethnology | 196 |
| For the Department of Mammals | 22 |
| For the Department of Comparative Anatomy | 15 |
| For the Department of Geology | 42 |

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* This bird received the first prize at the New York Poultry Exhibition, January, 1890.

| | |
|---|---|
| For the Section of Graphic Arts | 5 |
| For the Section of Transportation and Engineering | 32 |
| For the Smithsonian Institution | 3,000 |
| Miscellaneous prints | 660 |
| Enlargements of photographs | 8 |
| Cyanotypes (blue prints of plans and drawings) | 153 |

In pursuance of the agreement with the U. S. Fish Commission, Mr. Smillie has continued the photographic work of the Commission. This has consisted during the year of the following items:

| | |
|---|---|
| Negatives | 6 |
| Silver albumen prints | 586 |
| Cyanotypes | 243 |
| Photographs mounted | 70 |

The usual routine work has continued, including the numbering and filing of negatives, making up photographic outfits of expeditions, etc.

By order of the Assistant Secretary tests of inks have been made for the U. S. Geological Survey.

### DRAFTSMEN.

Mr. W. H. Chandlee and Mr. W. H. Burger have continued the preparation of illustrations for the Museum reports. Among them the more important are illustrations for papers by Prof. O. T. Mason, on "Arrows," "Skin-dressing," "Woman's Knives," "Hafting," "Toys and Games." A large number of drawings were made to accompany the paper by Mr. Romyn Hitchcock on "The Ainos of Yezo," and additional drawings have been made for Paymaster Thomson's paper on Easter Island. In addition a large amount of miscellaneous work has been accomplished, including the tracing and coloring of maps, charts, and diagrams, sketches of and for the arrangement of exhibits, topographical drawings, redrawings, engraving and lettering of labels, and numerous small paintings in water-color, oil, pastel, etc.

## H.—ACCESSIONS.

The total number of accessions to the Museum during the year is 1,162 (22179–23340, inclusive). This gives a decrease of 185 accessions as compared with those of 1889. It may be expected that each year will show a smaller number than the last until an additional building is provided by Congress. All special effort to obtain contributions has ceased, since there is no room where the specimens can be either exhibited or stored.

A tabulated statement showing the number of accessions to the Museum each year, beginning with 1881 (the first year of occupancy of the Museum building) is here given.

| Year. | Accession numbers (inclusive). | Number of accessions during the year. |
|---|---|---|
| 1881 | 9890–11000 | 1,111 |
| 1882 | 11001–12500 | 1,500 |
| 1883 | 12501–13900 | 1,400 |
| 1884 | 13901–15550 | 1,650 |
| 1885 (January to June) | 15551–16208 | 658 |
| 1885–'86 | 16209–17704 | 1,496 |
| 1886–'87 | 17705–19350 | 1,646 |
| 1887–'88 | 19351–20831 | 1,481 |
| 1888–'89 | 20832–22178 | 1,347 |
| 1889–'90 | 22179–23340 | 1,162 |

A geographical statement, showing the source of the more important accessions, is here presented:

## GEOGRAPHICAL REVIEW OF THE MORE IMPORTANT ACCESSIONS.

During the year, material has been received from almost every region in the world, a large proportion, however, coming from various parts of the United States.

This statement refers to the more important accessions. They are arranged, as far as possible, to indicate the localities from whence they are received, rather than the residence of the sender.

### AFRICA.

*Canary Islands.*—From Dr. E. Rey, of Leipsic, Germany, were purchased a number of birds' skins.

*Cape Town.*—Specimens of materia medica were received from the Botanic Garden, Mr. P. MacOwan, Director, through Mr. William Harvey Brown.

*Congo District.*—A collection of insects, crystals, minerals, and metals, specimens of *Musa* and *Pancratium* (plants), palm-fiber from which ropes, tops, mats, and many other things are made; gum copal, African rubber, cocoon of Congo silkworm, hippopotamus tusks, piece of skin from the *Congo seal*, and elephant hair, have been presented by Mr. J. H. Camp, of Herring, Ohio.

*Egypt.*—A pottery lamp, from Alexandria, was sent by Mr. M. F. Savage, of New York City.

*Liberia.*—Lieut. Frederic Singer, U. S. Navy, presented a termite queen from Sinou County.

*Morocco, New Caledonia, and neighboring islands.*—From the Ethnological Museum, Berlin, Germany, were received ethnological objects from these and other regions, and also specimens illustrating the ethnology of the Wasaguan negroes.

*Zanzibar.*—Dr. W. L. Abbott, of Philadelphia, Pennsylvania, who is making extensive journeyings in Africa and in other regions, has generously presented to the Museum some very interesting and valuable collections, among which are skins and skulls of large and small animals, including rhinoceros and buffalo heads, wart-hogs and antelopes, from the vicinity of Mount Kilima-Njaro; ethnological objects, including swords, daggers, knives, shields, arrows, clubs, wooden dishes, bowls, spoons, clothing, war-cap, basket-work, beaded belts, neck-rings, armlets and anklets, ear-ornaments, snuff-horns, medicine-girdle, a collection of insects, birds' skins, fishes, shells, head of snake, alcoholic reptiles, and skin of crocodile.

Specimens of South African tortoises, and alcoholic specimens of tortoises and chameleons, were placed in the hands of Mr. William Harvey Brown, for the National Museum, by Rev. George H. R. Fisk.

A collection of Coleoptera from South Africa was received from Mr. John H. Brady, of Cape Town, through Mr. William Harvey Brown.

From Mr. P. L. Jouy, U. S. National Museum, was received a specimen of garnet gravel, from the Kimberly diamond mines.

From the Oberlin College, Oberlin, Ohio, was received in exchange a collection of ethnological objects from South Africa.

A collection of marine and land shells from the Gaboon River was received from Mr. J. M. Griggs, of Brooklyn, New York.

A large and varied collection, gathered from various parts of Africa and the islands of the Pacific Ocean, was received from Mr. William Harvey Brown. This collection consists of minerals, alcoholic and dry shells, alcoholic and dry birds, alcoholic birds for skeletons, alcoholic crustacea, echinoderms, worms, snakes, lizards, fishes, mammal skins, and alcoholic mammals, alcoholic sea-weed, alcoholic and dry insects, plants, ethnological objects, fish-trap and spear, rocks, birds' eggs, etc. In making this collection Mr. Brown was materially assisted by the officers and seamen of the U. S. S. *Pensacola*. A carefully prepared report upon the collection will be published in the Proceedings of the National Museum, and a preliminary list will be found further on under the head of Explorations. The papers forming this report are the results of the work of the curators among whom the different specimens were distributed.

## AMERICA.

### NORTH AMERICA.

#### BRITISH AMERICA.

*British Columbia.*—A large and valuable collection of ethnological and natural-history objects, from the vicinity of Stewart's Lake and Fort St. James, was presented by Mr. R. MacFarlane, who for many years has been one of the most valued contributers to the Museum.

Four skins of Mountain-goat were presented by Mr. George Bird Grinnell, of New York City. These were collected by the donor in British Columbia.

*Vancouver Island.*—Mr. T. D. A. Cockerell, of West Cliff, Custer County, Colorado, transmitted, through Mr. W. G. Binney, of Burlington, New Jersey, a specimen (type) of *Prophysaon pacificum* Cockerell, from Victoria.

*New Brunswick.*—Mr. S. F. Cheney, of Grand Manan, sent a collection of nudibranchs, worms, crustaceans, and sponges.

*Labrador.*—From Miss Anna L. Ward, of Connecticut, were received a model of seal-skin *Igloo*, of the Eskimo; seal-skin coat; seal-skin tobacco pouch; a pair of seal-skin *kumings* (infant's shoes); bag of feathers, and two mounted seals.

*Manitoba.*—Mr. H. A. Perley, of Carberry, sent for examination and report a coin found near that place.

*Ottawa.*—From the Geological Survey of Canada (through Dr. A. R. C. Selwyn, director) were received paleozoic invertebrate fossils, among which was a fine specimen of *Clonograptus flexilis* Hall.

Prof. James Fletcher, of Ottawa, presented specimens of rare Coleoptera and Lepidoptera, characteristic of the Arctic regions.

*Quebec.*—Mr. William H. Dall, of the U. S. National Museum, contributed six very fine specimens of *Dictyonema sociale* Salter, from the Upper Cambrian, of Matanne.

The Reverend Abbe J. C. K. Laflamme, of Laval University, Quebec, contributed to the Department of Paleozoic Invertebrate Fossils a slab containing *Triarthrus becki* Green, *Leptobolus insignis* Hall, and *Climacograptus* sp., from the Utica Slate, of Beaufort.

*Selkirk.*—Dr. R. E. C. Stearns, of the U. S. National Museum, collected and presented a specimen of limestone from near Selkirk, on the line of the Canadian Pacific Railroad.

### CENTRAL AMERICA.

*Nicaragua.*—The Government of Nicaragua, at the instance of Mr. John Crawford, transmitted through Hon. José F. Medina a collection of engraved cocoa and chocolate cups, birds, reptiles, lava figures, and a hammock. These objects formed a part of the Nicaraguan exhibit at the Paris Exposition of 1889.

### MEXICO.

*Chihuahua.*—Twenty-five specimens of land-shells were presented by Mr. T. W. Stanton, of Washington, District of Columbia.

*Guanajuato.*—From Dr. Alfred Dugès was received a large collection of alcoholic fishes and alcoholic insects, dry insects, shells, marine invertebrates, dried plants, birds' skins, fragments of Indian skull, mammals, and reptiles.

*Guaymas and neighboring islands.*—From the U. S. Fish Commission were received specimens of insects, botanical specimens from Socorro and Clarion Islands, and specimens of reptiles from Kerdo. A collection of Echini was made in the North Pacific Ocean.

*Lower California.*—The Fish Commission sent specimens of insects from La Paz, collected by the steamer *Albatross;* a reptile, sample of guano, and a booby's nest from Angel de la Guardis Island and George's Island.

From Mr. Henry Hemphill, of San Diego, California, were received 100 species of marine shells and a series of Chitans. Mr. Hemphill also sent fresh-water shells from Oregon, representing about 200 species, Tertiary fossils, and 3 specimens of Sea-urchin, *Lovenia cordiformis*, from California.

From Lieut. Charles F. Pond, U. S. Navy, were received specimens of rocks, shells, sponges, nullipore coral, photographs of elephant tree, photograph of Port Jackson shark, specimen of hawk's egg, specimens of minerals, and lower jaw-bone of porpoise, from Cerros Island, San Benito Island, and Port San Bartolme.

*Monterey.*—Mr. B. M. Hayward, of Weybridge, Vermont, sent 12 specimens, representing 10 species, of birds' skins.

From Mr. Henry Ulke, of Hill City, South Dakota, was received an interesting collection of Mexican Coleoptera.

A large and valuable collection of Mexican plants was collected and presented by Mr. C. G. Pringle, of Charlotte, Vermont.

An interesting historical collection, consisting of a Mexican saddle and harness, chapeau, military cap, epaulets, revolver, and two rifles, personal relics of the late Gen. W. S. Harney, were deposited by Mrs. Mary E. Harney.

Messrs. Schuttler & Hotz, wagon-makers, of Chicago, Illinois, contributed to the Section of Transportation a characteristic Mexican cart.

### UNITED STATES.

*Alabama.*—The Fort Payne Coal and Iron Company sent specimens of limonite, hematite, and impure pyrolusite, taken from a mine at Fort Payne.

*Alaska.*—From Mr. W. H. Dall, U. S. Geological Survey, was received a collection of spiders and myriapods, collected by him on Gibson Island, Chichagoff Harbor.

A skin of the Pacific Kittawake (*Rissa tridactyla pollicaris*), from Kadiak, was presented by Dr. T. H. Bean, of the U. S. Fish Commission.

Several bidarkas with their appurtenances, collected in various parts of Alaska by agents of the Alaska Commercial Company, were received from the company.

The U. S. Fish Commission transferred to the Museum botanical specimens from Old Harbor, Kadiak, collected by the steamer *Albatross.*

*Arizona.*—From Dr. L. Stejneger, of the U. S. National Museum, were received specimens of mammal skulls, reptiles, birds' skins, and a roosting-nest of *Auriparus flaviceps.* Dr. Stejneger also presented a collection of mammal skins.

From the U. S. Geological Survey were received 260 specimens of minerals, collected by Dr. W. F. Hillebrand.

Through Maj. J. W. Powell, Director of the Bureau of Ethnology, was deposited a duplicate of a model of Wolpi, one of the Tusayan villages, and models of Sechimovi and Tewa, Tusayan pueblos.

The U. S. Fish Commission presented specimens of reptiles from Yuma and Tempe, and specimens of insects from Chino. These were collected by the steamer *Albatross.*

A specimen of green quartz containing gold was presented by Dr. R. H. Lamborn, of New York City.

*California.*—Maj. J. W. Powell, Director of the Geological Survey, deposited collections of quicksilver illustrating the results of investigations made on the California section of the Pacific coast under the direction of Mr. G. F. Becker.

From Mr. W. Otto Emerson, of Haywards, were received nests and eggs of *Melospiza fasciata samuelis*, *Melospiza fasciata heermanni*, and *Empidonax difficilis.*

Mrs. J. H. Tourtelette, of Minersville, Trinity County, sent 2 specimens of native gold from a mine on Digger Creek.

A limbless lizard (*Aniella pulchra*), peculiar to California, was sent by Dr. Thompson, of San Bernardino.

Mr. Edward Palmer presented a lizard from San Francisco.

Mr. A. W. Anthony, of San Diego, presented 3 eggs (1 set) of *Pelecanus californicus*, new to the collection.

From Mr. L. Belding, of Stockton, were received 7 specimens, representing 4 species, of birds' skins, among them a specimen of the recently described *Turdus sequoiensis* Belding.

A fire drill and fish-hook of the Nokum Indians, and 185 implements of obsidian, jasper, etc., were received from Mr. L. L. Frost, of Susanville. Mr. Frost also contributed ethnological objects and fossil plants.

Mr. Frank L. Belding, of Stockton, presented nests and eggs of *Cyanocitta stelleri frontalis*, *Ammodramus beldingi*, *Contopus borealis*, and *Turdus aonalaschkæ.*

From the U. S. Fish Commission were received specimens of reptiles, insects, and bats from Horse Shoe Bend; nest of Water-ouzel from McCloud River; stone implements and shells, four human skulls, one human skeleton, and one coyote skull from Santa Rosa Islands; also, one human skull from St. Nicholas Island. They were collected by the steamer *Albatross.*

Mrs. Burton M. Williamson, of University, Los Angeles County, sent shells from the coast of California.

*Colorado.*—The Colorado Biological Association, through Mr. T. D. A. Cockerell, secretary, sent a specimen of fungus, *Uromyces aconiti-lycoctoni* (D. C.), 3 specimens of *Pupa concinnula* n. sp., and an immature specimen of *Physa cupreonitens* n. sp.

*Connecticut.*—A collection of musical instruments, comprising square and upright pianos of the Mozart and Beethoven period, harpsichords, violins, violoncellos, violas, clavichord, and zither, has been deposited by M. Steinert, of New Haven.

*District of Columbia.*—Mrs. E. J. Stone, of Washington, sent a lace pillow with mahogany stand, with specimen of lace made 50 years ago by herself; lace pillow without stand, and specimen of bobinet lace; specimens of bead-work; moccasins made by the Dakota and Oneida Indians; highly polished steel paper-cutter from Mexico; rule of iron-wood taken from the old Government House at St. Augustine, Florida; tusks with ornamental etchings of classical figures; brass warming-pan and bread-toaster (each 120 years old); also maps of Washington from surveys made between 1800 and 1833; stereoscope containing daguerrotypes and transparencies by the albumen process, giving views of Niagara; shell basket of Cuban work; and marine invertebrates collected and prepared by Commodore Lenthall, U. S. Navy.

*Florida.*—Mr. J. M. Wilson, of Kissimmee, sent a Katydid (*Phylloptera oblongifolia*), remarkable for its red color.

*Illinois.*—A specimen of *Ancistrodon contortrix* was received from Dr. W. S. Strode, of Bernadotte.

From Dr. R. W. Shufeldt, U. S. Army, and Mr. G. F. Marcom, of Chicago, were received a fine series of water-fowls, ducks, geese, and mergansers, in the flesh.

*Indian Territory.*—Assistant Surgeon J C. Merrill, U. S. Army, Fort Reno, sent eggs of *Tympanuchus pallidicinctus; Progne subis; Spiza americana; Quiscalus quiscula æneus; Cardinalis cardinalis; Molothrus ater; Ammodramus savannarum passerinus; Vireo bellii.* Dr. Merrill also contributed a collection of birds' skins.

*Kentucky.*—From the Peabody Museum, Cambridge, Massachusetts, were received, in exchange, two torches from the Mammoth Cave, collected by Prof. F. W. Putnam and Dr. C. F. Metz.

*Maine.*—Concretions from Princess Point, Casco Bay, were received in exchange from Colby University.

Mr. W. H. Abbott, of the U. S. Fish Commission, presented 24 models of ships. These were collected by Mr. Abbott from several prominent shipbuilders, at the instance of Capt. J. W. Collins, of the U. S. Fish Commission.

*Maryland.*—Mr. Robert Ridgway, of the U. S. National Museum, presented 45 specimens, representing 37 species of birds' skins, from the vicinity of Laurel.

A series of rocks, showing inclosures of gneiss, limestone, etc., in eruptive granite, from quarries at Sykesville, were presented by Mr. G. P. Merrill, of the U. S. National Museum.

*Massachusetts.*—A collection of 7 daguerreotypes of Sioux Indians, taken from life 40 years ago, was received from Mr. W. D. Sanborn, of Winchester.

Mr. William Brewster, of Cambridge, sent eggs of *Tympanuchus cupido* and *Columba fasciata vioscæ*, both rare and new to the collection.

*Minnesota.*—From Mr. J. T. Benedict, of St. Paul, was received a skin of Bronzed Grackle (*Quiscalus quiscula æneus*), showing remarkable malformation of the lower mandible.

A gold medal, presented to Mr. Joseph Francis, of Minneapolis, by the President of the United States, April 12, 1890, by act of Congress, as a testimonial to his services in connection with life-saving appliances, was deposited by Mr. Francis.

Through Mr. C. D. Walcott, of the U. S. Geological Survey, were received specimens of *Lingulepis morsensis* and *Planolites* from the Trenton Group, Fountain.

*Missouri.*—A collection of prehistoric stone implements, from various localities in Greene County, were sent by Mr. J. W. Blankinship.

From Drury College, Springfield, was received a collection of 160 plants.

From the U. S. Geological Survey were received specimens of minerals collected by Mr. W. P. Jenney.

*Nebraska.*—From Mr. Glover P. Wilcox, Fort Niobrara, were received vertebræ of mastodon, alcoholic specimens of mammals, pieces of petrified wood, alcoholic snake, and pieces of bone and quartz.

*Nevada.*—From Mr. Charles A. Keeler, of Carson City, were received birds' eggs and birds' nests.

*New Jersey.*—A portion of the Hornblower engine, the first engine erected on the western continent, imported from England in 1753, was deposited by the New Jersey Historical Society, through Mr. S. F. Meeker, of Newark.

From Dr. W. G. Binney, of Burlington, was received a collection of American land-shells—types described by the donor. This completes the Binney collection in the National Museum.

A specimen of mussel pearl, from Absecon, was sent by Dr. Robert H. Lamborn, of New York City.

*New Mexico.*—Three alcoholic specimens of reptiles collected at Fort Wingate, were sent by Dr. R. W. Shufeldt, U. S. Army, of Takoma Park, District of Columbia.

From Maj. J. W. Powell, Director of the U. S. Geological Survey, were received 38 offerings from shrines.

Dr. L. Stejneger, of the U. S. National Museum, collected and presented specimens of birds' skins from Silver City and Fort Huachuca, Arizona. He also contributed the skull of a mammal.

*New York.*—Messrs. Tiffany & Co. sent a silvered copper electrotype copy of the vase presented to William Cullen Bryant in 1875 by the citizens of New York.

Prof. J. J. Stevenson, of the University of the City of New York, sent in exchange specimens of petroleum.

The first straight knife or sickle belonging to the Ogle-Brown reaping machine, invented by Mr. Henry Ogle and built by Mr. Thomas Brown and his son at Alnwick, England, about the year 1820, was received from Mr. Thomas S. Brown, of Poughkeepsie.

The Scientific Publishing Company, through L. Prang & Co., sent two sets of the plates accompanying Mr. G. F. Kunz's work on gems.

From Capt. F. L. Casey, Army building, New York City, were received types of new species of North American Coleoptera.

Through the U. S. Geological Survey was received a type specimen of *Conocoryphe reticulata* Walcott, from the Lower Cambrian of Salem, Washington. The Survey also deposited specimens of calcite and biotite from Port Henry, and magnetite crystals from Mineville.

*North Carolina.*—Mr. James Mooney, of the Bureau of Ethnology, contributed a Cherokee mortar and pestle, alcoholic specimens of reptiles, alcoholic specimens of insects, associated with the mythology of the Cherokee Indians, and also sent a large stump of a tree with bowlders imbedded in it.

Mr. W. C. Hodgkins, Assistant Superintendent of the U. S. Coast and Geodetic Survey, presented specimens of Indian bones, pottery, etc., from Peru Landing (formerly Hatche's Point), New River.

*Ohio.*—From Mr. John T. Gaddis, of New Washington, was received a perforated, boat-shaped object, of banded slate from Seneca County.

The Cincinnati Museum Association contributed 50 drawings executed by students in the Art Academy.

Three hundred and twenty-four archæological objects obtained from graves in an ancient cemetery and ash-pit near Madisonville, Ohio, were received in exchange, from the Peabody Museum, Cambridge, Massachusetts. These objects were collected by Prof. F. W. Putnam and Dr. C. F. Metz.

Three specimens of distilled zinc and magnesium, used in connection with a recent determination of the atomic weights of these metals, were received from Mr. W. M. Burton, of the Standard Oil Company, Cleveland.

*Oregon.*—From Mr. Henry Hemphill, of San Diego, California, were received about 200 specimens of marine shells, tertiary fossils, and fresh-water shells. A portion of these were collected in Lower California.

*Pennsylvania.*—Specimens of work executed by the pupils of Penn's Museum and School of Industrial Art were presented through Prof. L. W. Miller.

From Mr. F. Gutekunst, of Philadelphia, were received two books of specimens of phototypes, with a separate plate and duplicate.

Specimens of articles manufactured from aluminum were presented by the Pittsburgh Reduction Company, through Mr. A. E. Hunt, president.

Dr. Robert H. Lamborn, of New York City, sent specimens of williamsite from Wood's Chrome Mine, Lancaster County, and specimens of amazonstone and sandstone from Delaware County.

Mr. W. W. Walker, of Liverpool, sent in exchange a collection of archæological objects.

*South Dakota.*—Dr. V. T. McGillicuddy, of Rapid City, deposited 4 living specimens of American bison.

Mr. Henry Ulke, of Hill City, presented a valuable and well-mounted collection of North American Coleoptera.

*Texas.*—From Messrs. Ward & Howell, of Rochester, New York, was received a specimen of meteoric iron.

*Utah.*—From Capt. P. H. Ray, U. S. Army, Omaha, Nebraska, were received three paleolithic implements from the Bridger Basin, on the north slope of the Uintah Mountains.

*Virginia.*—The U. S. Geological Survey transmitted 22 photographs of the scenery in the region of the Great Dismal Swamp, collected by Mr. I. C. Russell, and minerals from Herndon, collected by E. L. Howard.

From the U. S. Fish Commission were received 115 specimens of crayfishes from Virginia, North Carolina, Tennessee, Michigan, and Indiana, obtained by Dr. D. S. Jordan, assisted by Dr. C. H. Bollman, during 1888.

Specimens of Ordovician (Trenton) fossils, and two crystals of limonite pseudomorph after pyrite, from near Lexington, were sent by Prof. James H. Morrison, of the Virginia Military Institute.

Specimens of reptiles, batrachians, and insects, collected by Dr. D. S. Jordan and his assistants, during the summer of 1888, in Virginia and elsewhere, were received through the U. S. Fish Commission.

From Dr. William C. Rives, of Newport, Rhode Island, were received two specimens of the Mountain Vireo (*Vireo solitarius alticola*), from White Top Mountain. These are new to the collection.

A specimen of quartz with inclusion, from Fairfax Court House, and a specimen of banded quartz, were presented by Dr. R. H. Lamborn, of New York City.

Mr. William T. Hornaday, of the National Museum, sent a living specimen of Woodchuck (*Arctomys monax*) captured near Rosslyn Heights.

*Washington.*—The Department of the Interior, through Hon. John W. Noble, Secretary, deposited a collection of ethnological objects from the Snohomish, Swinomish, Lummi, Muckleshoot, and Etakmur Indians, on the Tulalip Reservation. These were collected by Mr. E. C. Chirouse, agent in charge of the reservation.

*Wisconsin.*—Through Mr. C. D. Walcott, of the U. S. Geological Survey, was received a specimen of *Receptaculites oweni*, from the Trenton group, Ripon.

*Wyoming.*—From the Department of Agriculture, through Dr. C. Hart Merriam, was received a Horned Toad (*Phyrnosoma brevirostre*), from Bridger's Pass.

From the U. S. Fish Commission, through Col. Marshall McDonald, Commissioner, were received type series of fishes, alcoholic shells, specimen of *Mus musculus*, and alcoholic specimen of reptile, collected by Dr. D. S. Jordan in the Yellowstone National Park.

Dr. R. H. Lamborn, of New York City, sent a specimen of obsidian from the Yellowstone National Park.

From Mr. William T. Hornaday, of the U. S. National Museum, were received four skins of mountain sheep, in several stages of maturity.

### ISLANDS IN THE ATLANTIC OCEAN.

*Bermuda.*—Mr. Thomas Cunningham, of Chicago, Illinois, sent a sheet-lead impression from a historic inscription on Spanish Rock. This rock is located on the south shore of the island. The inscription is believed to have been cut in the face of the rock by Ferdinand Camelo, a Spanish navigator. A stunted red-cedar tree, which grows at the south end of the rock, has protected it from the elements, and from the overhanging branches were cut the tools with which the cast was made, and which accompany the impression sheet.

From the Wesleyan University, Middletown, Connecticut, were received the collection of annelids, from Bermuda, gathered by Dr. G. Brown Goode in 1877 (?), and identified by Prof. H. E. Webster, formerly of the University of Rochester, and now President of Union College at Schenectady. The following is a list of the annelids collected:

*Hermodice carunculata* Kinberg; *Eurythoë macrotricha* Baird; *Bhawania Goodei* n. sp.; *Halosydna leucohyba* (Schmarda); *Fallacia proctochona* (Schmarda) Qtrfg.; *Podarke obscura* Verrill; *Nereis Bairdii* n. sp.; *Nereis gracilis* n. sp.; *Eunice mutilata* n. sp.; *Eunice denticulata* n. sp.; *Eunice longisetis* n. sp.; *Eunice longicirrata* n. sp; *Eunice violaceà* Grube; *Marphysa acicularum* n. sp.; *Nicidion Kinbergi* n. sp.; *Arabella opalina* Verrill; *Œnone diphyllidia* Schmarda; *Anthostoma* Schmarda; *Ophelina maculata* n. sp.; *Arenicola cristata* Stimpson; *Cirratulus tenuis* n. sp.; *Terebella magnifica* n. sp.; *Enoplobranchus sanguineus* Verrill; *Protulides elegans* n. g., n. sp.; *Sabella melanostigma* Schmarda; *Hydroides dianthus* Verrill.

*Bahama Islands.*—From Mr. J. C. Maynard, of Newtonville, Massachusetts, were received 18 specimens of Strophia, types of new species described by the donor.

## WEST INDIES.

### GREATER ANTILLES.

*Santo Domingo.*—From G. L. Gillespie, lieutenant-colonel of Engineers, U. S. Army, was received a gun-carriage from the citadel of San Domingo City. This carriage is of mahogany, probably made by the Spaniards during the early days of their possession of the island. It was presented in February, 1890, by Gen. Frederic Lithgow, minister of war and of the navy of the Dominican Republic, to Capt. Nathan Appleton, of Boston, Massachusetts, and was presented by him to the National Museum.

*Little Cayman.*—From Mr. J. C. Maynard, of Newtonville, Massachusetts, were purchased 5 specimens of the recently described *Sula coryi* Mayn.

### LESSER ANTILLES.

*Barbadoes.*—From Rev. F. Gardiner, jr., of Pomfret, Connecticut, was received a basket, one game (Wa-wee), tambourine, violin and case.

*Trinidad.*—Mr. J. C. Hart, of Trinidad, sent 2 alcoholic specimens of *Eupemphix trinitatis.*

From Mr. Henry Balfour, of Oxford, England, were received in exchange 6 specimens of Carib stone celts.

## SOUTH AMERICA.

### BRITISH GUIANA.

The Demarara Museum, through Mr. J. J. Quelch, sent in exchange 4 skins of adult Hoatzins, *Opisthocomus cristatus*, several alcoholic specimens of the same, and 2 skeletons.

### CHILI.

Messrs. Ward and Howell, of Rochester, New York, presented a specimen of meteoric ore from Puquois.

From the Peabody Museum was received in exchange a basket, found by Prof. F. W. Putnam and Dr. C. F. Metz.

### GALAPAGOS ISLANDS.

From the U. S. Fish Commission were received alcoholic specimens of fishes collected by the steamer *Albatross* on the islands and northward.

### UNITED STATES OF COLOMBIA.

*Aspinwall.*—Dr. Joseph L. Hancock, of Chicago, Illinois, presented a living snake which was found coiled around a bunch of bananas. This has been transferred to the Zoölogical Park.

*Boyacá.*—From Mr. Carlos Martinez Silva, delegate from the United States of Colombia to the International American Conference, was received a case of butterflies from the famous emerald mines of Muso, State of Boyacá.

From the Museum of Comparative Zoology, Cambridge, Massachusetts, were received in exchange alcoholic specimens of South American Siluroids.

## ASIA.

### CHINA.

Mr. W. W. Rockhill (formerly of the American legation at Pekin) presented Chinese paper currency, and a collection of ethnological objects.

*Mongolia.*—Mr. Rockhill presented a collection of ethnological objects from western Mongolia.

*Thibet.*—Mr. Rockhill presented a collection of ethnological objects from Thibet. He also deposited several ethnological objects from eastern Thibet, consisting of a pair of silver earrings, finger-ring, shirt-buckle worn by women, a shirt-button; two kinds of Joss-sticks (incense) used in Thibet. He also deposited a chased iron seal, scroll-picture of the Lama convent of Tra shi thunpo in Thibet, strike-a-light set with jewels with jade toggle, brass-teapot, sword, knife and chop-stick in case, bow, arrow, and quiver, bow-case, and gold shirt-buckle.

### COREA.

Doctor H. N. Allen, secretary of the Corean legation at Washington, District of Columbia, deposited a large and valuable collection of Corean ethnological objects, and presented a specimen of gold ore from the Wen San mines, in the province of Pyong an do.

Mr. P. L. Jouy, of the U. S. National Museum, presented 10 specimens, representing 4 species, of land and fresh-water shells from Corea.

From Mr. W. W. Rockhill were received 18 Corean paintings, representing costumes.

### INDIA.

Mr. Edward Lovett, of Croydon, England, sent in exchange ethnological specimens from India. A series of ethnographical and archæological objects were also obtained from Mr. Lovett by purchase.

From the National Museum, Oxford, England, through Mr. Henry Balfour, was received in exchange a model of a Hindoo fire-drill.

Dr. Joseph L. Hancock, of Chicago, Illinois, presented 14 specimens representing 14 species of birds' skins from India.

### INDO-CHINA.

*Cambodia.*—From Mr. L. H. Jammes, of Realmont Tarn, southwest France, was purchased a collection of stone implements. The Mekong River, the principal river in Cambodia, each year, by reason of the melting of the snows in the mountains of the central plateau of Thibet, overflows its banks and inundates the lower country, which it traverses. Not far distant from the borders of an immense lake into which this river empties, have been found vast shell-heaps, and from this locality the specimens purchased from Mr. Jammes were obtained. The strata of the heaps of shells show different stages of civilization.

*Tonquin.*—Rev. A. Vathelet contributed 88 specimens of shells, comprising 30 species, from Tonquin and various localities.

### JAPAN.

*Osaka.*—From Mr. Romyn Hitchcock, of the U. S. National Museum, was obtained by purchase a *biva* or balloon-guitar.

*Sapporo.*—From the Sapporo Agricultural College, through Shosuke Sato, acting director, was received, in exchange, a collection of Aino articles.

*Tokio.*—The Insetsu Kioku (finance department), Tokio, through T. Tokuno, chief of Insetsu-Kioku, sent in exchange a collection illustrating Japanese methods of engraving and printing, and also presented

13 specimens of pigments used by the Japanese printers of chromoxylographs.

Hiramatz Rei, the chief Buddhist priest of Japan, presented a section of rope made of human hair, which had been used as an ordinary cable in lifting building-material in the construction of a Buddhist temple at Kyoto; a table of the names of the provinces of the donors, showing the size and length of each of the ropes used in the construction of the eastern Hon-gwan-ji temple at Kyoto, and a lithograph of the famous Buddhist temple. The above objects were transmitted through the Department of State, by the Hon. John T. Swift, U. S. consul at Tokio, Japan.

*Yokohama.*—Messrs. Fraser, Farley, and Varnum, of Yokohama, sent specimens of various grades of teas.

Mr. Romyn Hitchcock, of the U. S. National Museum, presented a collection of insects, mollusks, marine invertebrates, and a bat, *Vesperugo abramus*, collected in Japan, and in addition to these objects a collection of Aino articles, specimens of sulphur collected from the active volcano Iwo-san, botanical specimens from the islands of Yezo, Shikotan, and Yeterof (Iterup). A number of objects illustrating Japanese life were obtained from Mr. Hitchcock by purchase.

### ASIATIC RUSSIA.

*Syr-Darya.*—From Dr. E. Rey, of Leipsic, Germany, were obtained, by purchase, a collection of birds' skins. Eight birds' skins, gathered in different localities in Asia, were also obtained from him by purchase.

### ASIA MINOR.

*Armenia.*—Mr. H. de Morgan, of New York City, presented bones from Armenian graves at or near Allah-Verdi, collected by him. From him were obtained by purchase 78 specimens of prehistoric antiquities collected in America.

*Bagdad.*—From Dr. John P. Peters, of Philadelphia, Pennsylvania, was received a shepherd's pipe, used by the Arabs of Irak.

*Jerusalem.*—From Mrs. B. F. Ulman, of Baltimore, Maryland, was received a set of fringes for Jewish ceremonial garment.

*Tyre.*—Mr. M. F. Savage, of New York City, presented a lamp made of pottery.

### TURKEY IN ASIA.

*Island of Cyprus.*—Mr. Henry Balfour, of Oxford, England, sent in exchange a saucer-shaped lamp of pottery.

## EUROPE.

### AUSTRO-HUNGARY.

*Hungary.*—From Mr. Louis Molnar, of Molna Szecsöd, Empyházos Hollos, was received in exchange 86 specimens, representing 71 species of birds' skins, and 6 mammal skins.

## BELGIUM.

*Spiennes.*—Through Mr. Edward Lovett, of Croydon, England, was obtained by purchase a flint implement.

## DENMARK.

*Greenland* (belonging to Denmark).—From the Royal Museum, Stockholm, Sweden, was received a collection of minerals.

The Pennsylvania Salt Manufacturing Company, of Philadelphia, presented specimens of cryolite from Evigtok, Arksut-fiord.

*Iceland* (belonging to Denmark).—From Mr. George H. Boehmer, of the Smithsonian Institution, were received minerals from Iceland, consisting of stilbite, heulandite, Iceland spar, mesolite, native sulphur, and chalcedony. A collection of ores, rock, and fossil plants were presented by Mr. Boehmer.

*Island of Falster.*—From Mr. John B. Koch, of Bozeman, Montana, were received two flint hatchets.

*Island of Laaland.*—Mr. John B. Koch, of Bozeman, Montana, presented a flint hatchet from a dolmen on the island.

## ENGLAND.

*Bedford.*—From Mr. Edward Lovett, of Croydon, England, were obtained by purchase fragments of Roman pottery (Samian ware) from Bedfordshire, Dorset, Kent, and Suffolk, iron implements found in making excavations in the city of London, clay pipes, iron knives, keys, a shoe-buckle, of the sixteenth and seventeenth centuries, and a collection of ethnographical and archæological specimens.

*Cornwall.*—Mr. Samuel Lanyon, of Bradford, presented tin ore from the Dolcoath mine.

*Croydon.*—Mr. Edward Lovett presented a porter's knot, carrying-yoke and human harness. These objects were sent in exchange. Mr. Lovett also sent in exchange a collection of ethnological and archæological specimens, and obsolete specimens illustrating English lighting and cooking.

*Durham.*—Reverend A. M. Norman presented a collection of crustacea and echinodermata, chiefly Mediterranean.

*London.*—The British Museum presented a valuable series of bats from its reserve collection, and sent in exchange three meteoric casts and a specimen of orpiment.

From the Guildhall Library Committee, through Mr. Charles Welch, librarian, was received an interesting collection of medals, struck by order of the corporation of London.

*Oxford.*—From Mr. Henry Balfour was received a model of a Hindoo fire-drill, used to make sacred fire in temples.

*Windsor.*—From Prof. P. H. Carpenter, of Eton College, were received microscopic slides of shells, slides of foraminifera, one slide of annelid tubes, and a crab shell, collected by H. M. S. *Porcupine*, *Valorous*, *Lightning* and *Challenger* and mounted by Prof. W. B. Carpenter.

### FRANCE.

*Paris.*—The Museum of Natural History, Paris, France, sent in exchange 52 specimens of the hair of various races, representing fourteen types of mankind.

From Mr. A. Boucard, 7 skins of Birds of Paradise were purchased.

A gold box, diamond-mounted, presented to Mr. Joseph Francis, of Minneapolis, Minnesota, by the Emperor Napoleon III, in recognition of his inventions in connection with his life-saving appliances, was presented by Mr. Francis to the National Museum.

### ITALY.

*Florence.*—From Prof. T. Tozzetti were received in exchange 31 specimens, representing 8 species, of European *Microlepidoptera*, and 29 specimens, representing 8 species, of European *Orthoptera*.

*Genoa.*—From the Museum of Natural History, through Marquis Giacoma Doria, director, were received, in exchange, skin and skull of *Lophiomys imhausii*, 100 bats in alcohol, 2 shrews, and 1 Meadow-mouse.

Prof. R. Gestro sent in exchange 14 species of blind *Coleoptera* from the Mediterranean countries.

*Isle of Elba.*—From Mr. Clarence E. Bement, of Philadelphia, Pennsylvania, was received a specimen of pollucite.

### NORWAY.

*Trondhjem.*—From Dr. I. Hagen were received 320 species of Norwegian mosses.

From Mrs. Zelia Nuttall, of Dresden, Saxony, was received a set of antique carved Norwegian cart harness.

Specimens of minerals were received from the Royal Museum, in Stockholm, Sweden.

### RUSSIA.

*Finland.*—From the Royal Museum, Stockholm, Sweden, were received minerals.

*St. Petersburg.*—From Dr. F. Schmidt, of the Royal Society, was received a specimen of *Obolus apollinis*, Eichwald, from the Upper Cambrian of Esthonia.

### SWEDEN.

*Stockholm.*—From the Royal Museum were received specimens of minerals.

From Mr. John B. Koch, of Bozeman, Montana, was received a polished ax from Sweden.

### SWITZERLAND.

The Federal Department of Industry and Agriculture presented a collection of alcoholic specimens of fishes, comprising 89 specimens, representing 45 species.

### TURKEY.

*Constantinople.*—A Hebrew sacrificial platter, made in Constantinople and used in the celebration of the Passover, was purchased from Dr. Friedenwald, of Baltimore, Maryland.

## OCEANICA.

### AUSTRALASIA.

#### AUSTRALIA.

The Department of Agriculture, through Dr. C. V. Riley, entomologist, sent a collection of insects, gathered in Australia and New Zealand by Mr. A. Koebele, agent of the Department. This collection comprises 1,158 specimens, representing 342 species of *Coleoptera*, *Hemiptera*, and *Orthoptera*.

*New South Wales.*—From the Australian Museum, through Mr. Edward Ramsay, director, were received, in exchange, 44 specimens of percoid fishes, representing 34 species.

#### NEW CALEDONIA.

From the Ethnological Museum, Berlin, were received ethnological specimens from this and other regions.

#### NEW GUINEA.

M. A. Boucard, of Paris, France, presented to the Department of Birds a specimen of *Manucodia atra.*

### MALAYSIA.

*Macassar* (*Celebes*).—A living Macaque monkey, brought to the United States by the U. S. S. *Brooklyn*, was presented by Mr. S. Briggs, of of Washington, District of Columbia.

### POLYNESIA.

#### HAWAIIAN ISLANDS.

From King Kalakaua, through Hon. D. A. McKinley, His Majesty's consul-general at San Francisco, was received a supposed fossil tooth for examination and report.

From Mrs. Sybil Carter, of Washington, District of Columbia, was received a collection of ethnological objects, consisting of a feather-plume, hat, wallet, fan, bowl, anklet, Tapa club, carrying-club, photographs, etc., and a specimen of *Peles' hair* from the Hawaiian volcanoes.

Mr. C. A. Brown, of Honolulu, sent three specimens of Awa (Kava), representing the varieties of Puna, Makea, and Papa.

*Makaweli Kauai.*—Mr. Francis Gay, through Prof. H. Carrington Bolton, of New York City, presented a collection of fiber-yielding plants and fabrics.

*Waiawa.*—Mr. Valdemar Knudsen sent 48 specimens, representing 20 species, of birds' skins.

### SAMOAN ISLANDS.

*Apia.*—Dr. C. H. White, U. S. Navy, sent a collection of butterflies.

*Samoa.*—Dr. White, in addition to the collection from Apia, presented a large and valuable contribution of reptiles, fishes, insects, marine invertebrates, birds' skins, and a mammal skin.

Ensign W. E. Safford, U. S. Navy, presented a collection of 33 ethnological objects obtained by him.

Mr. J. D. Milligan, of Boston, Massachusetts, presented 2 specimens of *Cypræa arabica* L.

Mr. Harold M. Sewall, of Bath, Maine, presented a Samoan fire-stick.

Malietoa, Mataafa, and other chiefs of high rank in the Samoan Islands, presented the United States Government, through Rear-Admiral L. A. Kimberly, a collection of ethnological objects, among which were several objects of great value to them. These were sent as a token of their esteem for the friendly interest shown by the United States during the troubles which occurred in the islands.

### EASTER ISLAND.

Mr. M. F. Savage, of New York City, sent a feather head-dress from this island.

## I.—COÖPERATION OF THE DEPARTMENTS AND BUREAUS OF THE GOVERNMENT.

The National Museum has continued to receive from the Departments and Bureaus of the Government many valuable and interesting collections. The U. S. Geological Survey, whose interests are closely allied with those of the Museum, has, as in past years, been instrumental in obtaining large and valuable collections of geological material, which, after being worked over by the geologists connected with the Survey, have been incorporated with the Museum collections.

The valuable services rendered by several officers of the Army and Navy are highly appreciated. The Department of State has, through its ministers and consuls, rendered important assistance in enlarging the collections of natural history and ethnological objects from foreign countries.

## DEPARTMENT OF STATE.

The Government of Switzerland has presented, through Maj. Karl Kloss, chargé d'affaires for Switzerland, a collection of 89 alcoholic specimens, including 45 species, of fishes from Switzerland.*

The Hon. John T. Swift, United States consul at Tokio, Japan, transmitted a section of rope made of human hair, which had been used as an ordinary cable in lifting building-material in the construction of a Buddhist temple at Kyoto, Japan; a photograph of the entire rolls of cables, similarly constructed, still remaining at the new Buddhist temple at Kyoto. A list of the names of the provinces of the donors, showing the size and length of each of the ropes used in the construction of the eastern Hon-gwan-ji temple at Kyoto, and a lithograph of the famous Buddhist temple, were also received. These objects were presented by Hiramatz Rei, chief Buddhist priest of Japan.

Through Hon. Thomas J. McLain, United States consul at Nassau, West Indies, were received specimens of sisal.

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**List of species.*

| Species. | From— | Species. | From— |
|---|---|---|---|
| Perca fluviatilis L. | Ponte Tresa. | Telestes Agassizii Heckel. | Aar. |
| Do. | Aar. | Telestes Savignyi Bonap. | Pointe Tresa. |
| Acerina cernua L. | Rhine (Basel). | Proxinus lævus L. | Aar. |
| Gasterosteus gymnurus Cuv. | Do. | Chondrostoma nasus L. | Do. |
| Cottus gobio L. | Tessin. | Chondrostoma soetta Bonap. | Ponte Tresa. |
| Do. | Lake of Thoune. | Coregonus Wartmanni, acutirostris Tatio. | Lake of Constance. |
| Lota vulgaris Cuv. | Lake of Morat. | Coregonus crassirostris nobilis Haak. | Lake of Thoune. |
| Tinca vulgaris Cuv. | Aar. | Coregonus restrictus, Bondella Tatio. | Lake of Neuchatel. |
| Barbus fluviatilis Ag. | Do. | Coregonus Schnisii alpinus Tatio. | Lake of Thoune. |
| Barbus plebejus Bon. | Ponte Tresa. | Thymallus vulgaris Nilss. | Aar. |
| Barbus caninus Val. | Do. | Salmo salvelinus L. | Lake of Zug. |
| Gobio fluviatilis L. | Lake of Morat. | Trutta lacustris L. | Lake of Thoune. |
| Rhodeus amarus L. | Basel. | Trutta fario L. | Lake of Berne. |
| Abramis brama L. | Lake of Moosseedorf. | Esox lucius L. | Do. |
| Blicca bjoerkna L. | Lake of Morat. | Do. | Ponte Tresa. |
| Spirlinus bipunctatus Bl. | Aar. | Alosa vulgaris Cuv. | Rhine. |
| Alburnus lucidus Heckel. | Lake of Thoune. | Silurus glanis L. | Lake of Bienne. |
| Alburnus alborella de Fil. | Ponte Tresa. | Cobitis fossilis L. | Basel. |
| Scardinius erythrophthalmus L. | Do. | Cobitis barbatula L. | Berne. |
| Scardinius erythrophthalmus L. | Aar. | Cobitis tænia L. | Tessin. |
| Leuciscus rutilus L. | Do. | Anguilla vulgaris Fl. | Berne. |
| Leuciscus rutilus var. | Lake of Bienne. | Petromyzon Planeri Fl. lavo. | Aar. |
| Leuciscus pigus de Fil. | Ponte Tresa. | Petromyzon Planeri ad. | Do. |
| Leuciscus aula Bonap. | Do. | Petromyzon fluviatilis L. | Rhine (Basel). |
| Squalius cephalus L. | Aar. | | |
| Squalius leuciscus L. | Do. | | |
| Squalius cavedanus Bonap. | Ponte Tresa. | | |

Mr. J. Crawford, of Nicaragua, has expressed his intention of obtaining the consent of the Nicaraguan Government to permit the representative of Nicaragua at the Paris Exposition to transfer to the Smithsonian Institution such portions of the exhibit at Nicaragua as may be desired. The Department of State has kindly offered to render assistance through its minister in Central America.

### TREASURY DEPARTMENT.

The National Museum is much indebted to this Department for its continued assistance in connection with the free entry of imported objects and for the interest displayed by several of its bureaus in the work of the Museum.

In connection with the intended visit of Mr. Henry W. Elliott, formerly in the service of the Alaska Commercial Company, to the seal islands of Alaska, on business of the United States Government, the Secretary of the Treasury kindly permitted a taxidermist, selected by the Smithsonian Institution, to accompany Mr. Elliott, for the purpose of collecting specimens for the Museum, and extended special assistance with a view to facilitating their preservation.

At the request of the Secretary of the Smithsonian Institution special facilities were afforded by the Department to Mr. W. E. D. Scott, who had expressed his intention of visiting Florida keys in February, 1890, for the purpose of studying the birds of that region and of making a collection of birds' eggs for the National Museum. Capt. F. M. Munger, of the revenue steamer *McLane*, stationed at Key West, was instructed by the Secretary of the Treasury to aid Mr. Scott in every way in his power.

*Life-Saving Service.*—Capt. A. H. Meyers, of the life-saving station at Quoddy Head, Maine, sent photographs of a whale (*Balænoptera rostrata*).

*Revenue Marine Division.*—From Hon. Peter Bonnett, chief of the division, were received 35 photographs of Eskimo and Alaskan scenery.

An interesting collection of 89 photographs of Alaska was obtained by Capt. M. A. Healy, of the revenue steamer *Bear*, and sent to the Museum through the Alaska Commercial Company.

*Coast and Geodetic Survey.*—Dr. T. C. Mendenhall, Superintendent, kindly supplied charts of the Florida coast to aid Mr. W. E. D. Scott in his investigations of the ornithology of the region.

A collection of Indian bones and pottery was obtained and transmitted by Mr. W. H. Hodgkins, assistant superintendent. These were procured from Peru Landing, formerly Hatche's Point, New River, North Carolina.

*Light-House Board.*—The naval secretary, at the request of the Secretary of the Smithsonian Institution, instructed the light-house keepers on the Florida coast to assist Mr. W. E. D. Scott in his investigations of the ornithology of the region.

## WAR DEPARTMENT AND THE ARMY.

The Hon. Redfield Proctor, Secretary of War, has transmitted to the Museum two swords presented to the late Gen. James Shields by the States of South Carolina and Illinois for gallant services in the Mexican War.

From Gen. M. C. Meigs, U. S. Army (retired), was received a whistle, supposed to have been found in an Indian mound near Columbus, Georgia.

A living Chachalacca pheasant, was presented by Maj. George W. McKee, U. S. Army, Allegheny Arsenal, Pittsburgh, Pennsylvania.

Capt. W. L. Carpenter, Ninth Infantry, U. S. Army, presented a skin of the Rocky Mountain Lined-tailed Spermophile (*Spermophilus grammurus*) from Fort Whipple, Arizona. Captain Carpenter also presented alcoholic specimens of reptiles, fishes, and insects from the same locality.

Capt. Henry Romeyn, U. S. Army, presented 13 living White-winged Doves (*Melopelia leucoptera*) from Fort Ringgold, Texas. He also presented specimens of clay tunnels constructed by ants, and two living Peccaries (*Dicotyles tajuça*).

Capt. P. H. Ray, U. S. Army, Omaha, Nebraska, sent palæolithic implements from the Bridger Basin, on the north slope of the Uintah Mountains, Utah.

From Lieut. H. C. Benson, U. S. Army, were received 3 eggs (1 set of the long-crested Jay (*Cyanocitta stelleri macrolopha* Baird).

Lieut. Malvern Hill Barnum, U. S. Army, Fort Pena, Colorado, Texas, presented a set of 12 eggs and a skin of the Scaled Partridge (*Calli pepla squamata* Vig.).

Dr. R. W. Shufeldt, U. S. Army, sent 8 specimens, representing 3 species of Juncos, from Fort Wingate, New Mexico. Also a mounted skeleton of Trumpeter Swan (*Olor buccinator*).

An exceedingly interesting series of 12 ethnological specimens from the Navajo Indians was received from Dr. Washington Matthews, U. S. Army, Army Medical Museum.

Assistant Surgeon J. C. Merrill, U. S. Army, Fort Reno, Indian Territory, presented 14 eggs (1 set) of *Tympanuchus pallidicinctus;* 19 eggs (4 sets) of *Progne subis;* 18 eggs (4 sets) of *Spiza americana*, and 2 nests; 4 eggs (1 set) of *Quiscalus quiscula æneus;* 3 eggs (1 set) of *Cardinalis cardinalis;* 1 egg of *Molothrus ater*; 5 eggs (1 set) of *Ammodramus savannarum passerinus;* and 3 eggs (1 set) of *Vireo bellii.*

Through G. L. Gillespie, lieutenant-colonel of Engineers, U. S. Army, was transmitted a gun-carriage, brought from the citadel of Santo Domingo City. This carriage is of mahogany, and was probably made by the Spaniards during the earlier days of their possession of the island. It was presented in February, 1890, by Gen. Frederic Lithgow, minister of war and the navy of the Dominican Republic, to Capt. Nathan Appleton, of Boston, Massachusetts, by whom it was presented to the National Museum.

The Quartermaster-General has rendered important assistance in connection with the transportation of four living buffaloes from Rapid City, South Dakota, to Washington. The thanks of the Museum are also due to Lieut. Col. William B. Hughes, chief quartermaster of the Department of the Platte, at Omaha, Nebraska, for facilitating the work of transportation in many ways. Through the courtesy of the Quartermaster's Department several bidarkas, collected for the National Museum in Alaska, were forwarded to Washington.

Capt. C. E. Bendire has continued his work as curator of the collection of Birds' Eggs, and the thanks of the Museum are due to him for the excellent condition of the collection.

### NAVY DEPARTMENT AND THE NAVY.

The Museum is under obligation to several officers of the U. S. Navy for the addition of valuable contributions to the collections.

Commodore J. G. Walker, Chief of the Bureau of Navigation, sent specimens of ocean bottom, taken in the North Atlantic Ocean during the passage of the U. S. S. *Dolphin*, under the command of Commander F. F. Wilde, U. S. Navy, from the Straits of Gibraltar to New York.

From Commander C. H. Rockwell was received a specimen of *Ostracion quadricorne*, from Santiago de Cuba.

Lieut. George T. Emmons presented a Haida whistle, the sound of which was an imitation of the young deer, from the southern part of Prince of Wales Island, Alaska; four photographs illustrating witchcraft in Alaska, and among the Hydahs and Tlingits; and a plaited wallet from Washington.

From Lieut. Charles F. Pond were received rocks, minerals, and shells, from Lower California and adjacent islands; two photographs and the lower jawbone of a porpoise found on the beach at San Bartolme, Lower California.

Lieut. Frederic Singer presented to the Department of Insects a termite queen, from Sinou County, Liberia.

From Ensign W. E. Safford was received a collection of 33 ethnological objects obtained by him in the Samoan Islands.

Dr. C. H. White, U. S. Navy, sent a large and valuable collection of alcoholic specimens of reptiles, fishes, insects, marine invertebrates from Samoa, and a collection of butterflies.

Malietoa, Mataafa, and other chiefs of high rank at Samoa, presented to Rear-Admiral Kimberly, for the United States Government, a number of ethnological objects. Some of the mats sent are very handsome and of great value, in many cases being heir-looms.

Paymaster William J. Thomson has finished the preparation of an elaborate paper on the ethnology of Easter Island. This is published in the Report for 1889.

Dr. J. M. Flint is still in charge of the Section of Materia Medica, and the collection is, as usual, in excellent condition.

## DEPARTMENT OF THE INTERIOR.

The Hon. John W. Noble, Secretary, has deposited in the Museum a collection of ethnological specimens, collected among the Indians of the Tulalip Reservation, Washington, by Mr. E. C. Chirouse, agent in charge of the reservation.

*Indian Office.*—From General T. J. Morgan, Commissioner of Indian Affairs, was received a wooden hoe, used by the Indians of the Chippewa Reserve, Wisconsin.

*U. S. Geological Survey.*—The following statement will show the extent of the contributions received from the Survey during the year:

The U. S. Geological Survey presented a type specimen of *Conocoryphe reticulata* Walcott, from the Lower Cambrian of Salem, Washington County, New York; miscellaneous collection of geological material from Madison County, Montana; 30 specimens of minerals; 21 transparencies for windows in the exhibition hall of the Department of Lithology; sandstone with mud and ripple-marks from Grand Cañon group, 7,000 feet below the base of Cambrian, Grand Cañon of Colorado, Arizona; fossils from the Lorraine formation of the Ordovician from several localities in New York, and 36 specimens, comprising 11 genera and 18 species of Lower Cambrian fossils from several localities; specimens of fresh-water Gasteropoda from the Bonneville and Lahontan beds, Utah, and fossils from Nevada; 38 objects, offerings from shrines in New Mexico; specimens of kyanite and anthophyllite from Virginia; and a specimen of iridescent limonite from Cuba, collected by Mr. W. J. McGee; two specimens of urao and one of potassium platinic chloride, prepared by Dr. T. M. Chatard; a specimen of selenite from Fort Washington, Maryland, collected by Mr. George W. Cook; specimens of thinolite from Lake Lahontan, and of wulfenite and cerussite from the Richmond mine, Eureka District, Nevada, collected by C. D. Walcott; specimen of wulfenite from Eureka, Nevada; 287 specimens, representing 24 genera and 32 species of fossils from the Lower Cambrian, Ordovician, and Silurian; 9 specimens of *Lingulepis morsensis*, and 2 specimens of *Planolites* sp., from the Trenton group, Fountain, Minnesota; one specimen of *Receptaculites oweni* from the Trenton group, Ripon, Wisconsin, collected by Mr. C. D. Walcott; living serpents collected by Col. George W. Shutt; 22 photographs of scenery of the Great Dismal Swamp, collected by Mr. I. C. Russell; collections showing the results of the quicksilver investigations of the Pacific Slope, made under the authority of Mr. G. F. Becker; 41 specimens, representing 11 species of Devonian Brachiopoda, from Independence, Iowa; 7 specimens of graphite and specimens of pyrite crystals, calcite and magnetite, from Port Henry, Minnesota, collected by Prof. F. W. Clarke; casts of supposed human foot-prints discovered in the limestone formation near Forest City, South Dakota, sent by Mr. J. C. Collister; specimens of native gold associated with calcite from a mine on Digger Creek, near Minersville, Trinity County, California, sent by Mrs. J. H. Tourtelette, through Mr. J. S. Diller; 13 specimens of minerals, collected by Mr. W. P. Jenney, from Southwest Missouri and neighboring localities, and 3 specimens of marbles from Sugar Orchard Creek, Boone County, Arkansas; a specimen of alunite from Brooklyn Tunnel, Red Mountain District, San Juan, Colorado, collected by Prof. S. F. Emmons; 105 specimens of vanadinite and 1 specimen of wulfenite, from the old Yuma mine, near Tucson, Arizona, collected by Dr. W. F. Hillebrand; a specimen of wulfenite from the Red Cloud mine, Yuma County; 70 specimens of vanadinite from Aqua Fria mine, Yavapai County; a specimen of iodorite from the Old Man mine, near Silver City, New Mexico; 260 specimens of minerals from the Copper Queen mine, Bisbee, Arizona; 64 specimens of vanadinite from the Hamburg mine, Silver District, Arizona, and from the Clara mine, in same locality, and 26 specimens, representing seven genera and 8 species of Cambrian and Ordovician fossils, collected by Mr. C. D. Walcott.

The Survey also deposited specimens of biotite and calcite, from Port Henry, and specimens of calcite on dolomite and magnetite; also copies of two models of Mount Shasta, California. Six slabs of stone exhibiting glacial striæ were received. Two of these were collected by Mr. G. K. Gilbert, in Canada; the remainder by Prof. T. C. Chamberlin.

Several officers of the Geological Survey are officially connected with the Museum in the capacity of honorary curators. These are: Dr. C. A. White, in charge of Mesozoic Fossils; Mr. C. D. Walcott, in charge of Paleozoic Fossils; Mr. William H. Dall, in charge of Mollusks and Tertiary Fossils, with Dr. R. E. C. Stearns as adjunct curator; Prof. O. C. Marsh, in charge of Vertebrate Fossils; Prof. Lester F. Ward, in charge of Fossil Plants; Prof. F. W. Clarke, in charge of Minerals.

## DEPARTMENT OF AGRICULTURE.

Hon. Edwin Willits, Assistant Secretary, transmitted a living Otter, obtained by Dr. Allen Stuart, of Beaufort, South Carolina.

The extensive collections of small mammals made by the Division of Economic Ornithology and Mammalogy, have been deposited in the Museum building. A considerable number of cases especially constructed for their reception, and of trays, have been provided by the Museum. The specimens have been entered promptly by clerks employed by the Museum exclusively for that purpose, and the skulls have been cleaned as fast as received, so far as this was found to be possible. This latter work has made it necessary to employ from time to time a number of additional preparators. More than three thousand specimens, comprising skins and skulls, were deposited during the year, and entered upon our catalogues and numbered. The cleaning of the skulls, with a view to putting them into condition for preservation and exhibition, was a task of considerable magnitude. The Museum has also provided glass vials and preservatives, and has printed a certain number of special labels for these specimens.

Dr. C. Hart Merriam has presented an interesting collection of reptiles from Arizona; two living Canada Porcupines (*Erethrizon dorsatus*) from northern Minnesota; a Horned Toad (*Phrynosoma brevirostre*) with a sample of the earth upon which it was living, from Bridger's Pass, Wyoming; nests and eggs of *Spizella breweri*, *Sturnella magna neglecta*, and *Falco richardsoni*.

Prof. C. V. Riley, entomologist of the Department, has added to the collection of insects a large series, comprising 1,158 specimens, representing 342 species of Coleoptera, Hemiptera, and Orthoptera, gathered in Australia and New Zealand by Mr. A. Koebele, agent of the Department. Professor Riley has also deposited the collection of insects of the late Dr. Asa Fitch.

Mr. L. O. Howard, assistant entomologist of the Department, sent a tussa silk-moth reared by him from a cocoon sent to the National

Museum from India. The thanks of the Museum are due to Mr. Howard for his services as acting curator of the Department of Insects in the Museum during the absence of the honorary curator.

Through Dr. B. E. Fernow, chief of the Division of Forestry, has been received a large map which was exhibited at the Paris Exposition, showing the percentage of forest-areas.

The valuable services of Professor Riley, as honorary curator of the Department of Insects; of Dr. B. E. Fernow as honorary curator of the forestry collection, and of Dr. George Vasey, as honorary curator of the Department of Botany, have been continued.

### UNITED STATES FISH COMMISSION.

The cruise of the steamer *Albatross* in the West Indies and in the Pacific Ocean has resulted in some very important additions to the collections of the National Museum.

The following statement gives the general character of these collections, which have been transmitted to the Museum by Col. Marshall McDonald, Commissioner of Fisheries.

A series of Echini from the North Pacific Ocean; 226 specimens of birds collected by the naturalists of the steamer *Albatross* on the west coast of America during 1888–'89. (The collection was made mainly through the efforts of Mr. Charles H. Townsend.) A collection of alcoholic fishes from Galapagos Islands; specimens of bats, coyote skull, botanical specimens, dried plants, guano, birds' nests, stone implements and shells, human skulls and skeleton, specimens of natural history, reptiles and batrachians, and insects from the western coast of North America, were also received. Samples of dried hake sounds, and sheet isinglass manufactured from the same, two Gulls (*Larus glaucescens*), fresh specimens of Pickerel and of Weak-fish from the aquaria of the Commission, two skeletons of Cormorants (*Phalacrocorax dilophus* and *Phalacrocorax penicillatus*) and a stuffed skin of Saw-fish (*Pristis pectinatus*), have also been received.

Through Dr. D. S. Jordan, president of the Indiana State University, have been received type series of fishes collected in Colorado, Utah, and Kansas; 115 specimens of cray-fishes from Virginia, North Carolina, Tennessee, Michigan and Indiana. Specimens of reptiles, batrachians, and insects, collected in Virginia and elsewhere, also type series of fishes, alcoholic shells, mammals, and reptiles from the Yellowstone Park have been received. Dr. Jordan has made several important collections of fishes during the summer, and, with the assistance of Dr. Bollman, has described them. These descriptions have been published by the Fish Commission. The fishes have been transferred to the collection in the National Museum.

Mr. William F. Page, superintendent of the U. S. Fish Commission station at Neosho, Missouri, presented the wing of a bird which was shot on the grounds of the station, and a specimen of Black Tern (*Hydrochelidon lariformis surinamensis*).

Through Mr. Vinal N. Edwards fresh specimens of eels collected at Wood's Holl, Massachusetts, were received.

From Messrs. Leslie A. Lee and Thomas Lee was obtained a collection of spears, spear-points, baskets, and other ethnological objects, from the Fuegian Islands, South America.

Mr. William P. Seal, superintendent of the aquaria at Wood's Holl, Massachusetts, sent a fresh specimen of Sheepshead (*Diplodus probatocephalus*) from Chesapeake Bay.

At the instance of Capt. J. W. Collins, a valuable collection of builders' models of vessels was obtained from Mr. W. H. Abbott, of the U. S. Fish Commission. A list of the models is given in the accession list.

The valuable services of Mr. Richard Rathbun, as honorary curator of Marine Invertebrates; Dr. Tarleton H. Bean, as honorary curator of Fishes; and Capt. J. W. Collins, as honorary curator of Naval Architecture, have been continued through the courtesy of the Commissioner.

### BUREAU OF ETHNOLOGY.

Through the coöperation of Maj. J. W. Powell, Director, the following collections have been received from the officers of the Bureau:

From Rev. J. Owen Dorsey were received two models of fish-hawks and one model of retrieving-harpoon, from the Năl-tûn-né tûn-né Indians of Oregon.

A model of Wolpi, one of the Tusayan villages, Arizona, and models of Tewa and Sechomovi, Tusayan pueblos, have been deposited in the Museum.

From Mr. James Mooney were received a collection of baskets, moccasins, polishing-stones, conjuring-stones, ball-pants, scratchers, bullet-mold, lancet, cupping-horn, etc., obtained from the East Cherokee Reservation, North Carolina.

Through the courtesy of the Director, the Department of American Prehistoric Pottery in the National Museum, which was established several years ago, has continued under the curatorship of Mr. W. H. Holmes.

## J.—EXPLORATIONS.

By an act of Congress,* provision was made to defray the expense of sending a scientific expedition to the west coast of Africa for the purpose of observing the total eclipse of the sun, occurring on December 22, 1889. In accordance with the recommendations of a board appointed by the Chief of the Bureau of Navigation to devise plans, etc., the details of the expedition were arranged.

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* Passed March 2, 1889.

Through the courtesy of Prof. David P. Todd, of Amherst College, Massachusetts, in charge of the expedition, arrangements were made whereby Mr. William Harvey Brown, of the National Museum, was detailed to accompany the expedition in the interest of the Museum, for the purpose of making collections of natural history objects, especially fishes and mammals.

The expedition party sailed on October 16, 1889, on the United States steamer *Pensacola.* The steamer served as headquarters for Mr. Brown and his party, and in making the collections he has been very generously assisted by the officers and seamen.

At the Azores, Mr. Brown made a small collection of fishes and shells. Writing from Cape Town on February 3, 1890, he says:

> We have succeeded in filling 15 tanks and a number of jars and bottles with alcoholics, besides collecting a large number of plants and insects, some skeletons, and some excellent anthropological material. The ungulates of South Africa are rapidly disappearing before the advance of civilization; some are already scarce. If we want a good representation of these in our Museum, now is the time to get them.

Several important collections were received in June, 1890.

From preliminary reports prepared by some of the curators in the Museum the following preliminary statement has been compiled:

ETHNOLOGY.—The Department of Ethnology received a collection of objects, consisting of an idol used in fetish-dance, with grass-fringe dress; gaming-stool, with seeds used in playing; carrying or fishing-basket of twined open work; long carrying-basket or frame, showing work of weaving; finer specimen of carrying-basket; complete outfit of professional carrier, head-band and staff; fruit-wallet; throwing-club; hoe (of native manufacture); bottle of fetish-paint, made of rawhide; pad worn on the arm; musical instrument with gourd resonator; musical instrument (stringed); drum used in fetish ceremonies; weaving outfit, distaff, spindle, cotton-ginning sticks, loom complete with specimens half done; pipe of clay; three pottery dishes; fish-fyke, and fish-spear. All of these objects are new and very acceptable.

MAMMALS.—The mammals collected by the Eclipse Expedition are 33 in number and represent 16 species. With the exception of 7 specimens all were collected at Cunga, on the Coanza River, in Angola. Only two of the species, the Black Rat (*Mus rattus*) and the Bonte-bok (*Alcelaphus pygargus*), were previously represented in the National Museum, and the collection, though small, is of considerable interest.

The following is a list of the mammals received:

### *Carnivores.*

*Genetta pardina* Geoff. Pardine Genet. Male, adult. Cunga.

### *Antelopes.*

*Tragelaphus gratus* Sclater. Bush Buck.
Male, Cunga, December 28, 1889. (18793.)
Female, Cunga, December 27, 1889. (18794.)

Two excellent skins of this fine antelope were collected by the expedition. The white preocular band is not strongly marked in the male and it is absent in the female. The type of the species was from the Gaboon.

*Tragelaphus sylvaticus* (Sparrm.) Bush Buck.
Horns of a male. From South Africa. Presented by Mr. Frye. (18823.)
*Gazella euchore* (Lichtenstein). Spring-bok.
Two pairs of horns. From South Africa. Presented by Mr. Frye. (18820–21.)
*Alcelaphus pygargus* (Pallas). Bonte-bok.
A pair of horns. From South Africa. Presented by Mr. Frye. (18822.)
*Cephalophus grimmia* (Linné). Duyker Antelope.
A pair of horns from South Africa. Presented by Mr. Frye. (18824.)

*Bats.*

*Phyllorhina commersoni* (Geoff.).
Male, adult, Cunga, Dec., 1889. (18795.)
Female, adult, Cunga, Dec., 1889. (18796.)
*Nycteris macrotis* Dobson.
Male, adult, Cunga, Dec. 25, 1889. (18797.)

The type of this species is from Sierra Leone. It is not included by M. Barboza du Bocage among the mammals of Angola, and its discovery in this region is therefore of interest.

*Scotophilus borbonicus* (Geoff.).
Female, adult, Cunga, Dec. 25, 1889. (18798.)
*Nyctinomus limbatus* (Peters).
Three adult females from Cunga, Dec. 25, 1889. (18799–18801.)
Five adult males from Cunga, Dec., 1889. (18802–18806.)

*Rodents.*

*Mus rattus* Linne. Black rat.
Females, adult, Cunga, Dec., 1836. (18808, 9, 15.)
Females, young, Cunga, Dec., 1889. (18811, 12.)
Males, adult, Cunga, Dec. 25, 1889. (18813, 14.)
Males, young, Cunga, Dec., 1889. (18810, 16.)
*Mus* sp.
Female, adult, Cunga, Dec., 1889. (18817.)

This is a small rat with white belly, apparently resembling *M. maurus* of Gray.

*Lepus capensis* F. Cuv. Cape Hare.
Near Cape Town, South Africa, Feb. 4, 1890. (18818.)
*Atherura africana* Gray. African Brush-tailed Porcupine.
Almina, Ashantee, Nov. 27, 1889. (18819.)

REPTILES AND BATRACHIANS.—The Department of Reptiles and Batrachians has received a number of specimens from the naturalists attached to the expedition. Some of them were not in a satisfactory state of preservation, and from the fact that the collection was made under unfavorable circumstances, in localities already more or less explored, it could hardly be expected to contain many new species.

FISHES.—The Department of Fishes received a large collection, a list of the genera of which, together with the locality, is given below.

## FISHES (MARINE SPECIES).

### *Horta, Island of Fayal, November* 2, 1889.

*Tetrodon.*
*Scomber.*
*Lichia.*
*Box.*
*Mugil*, juv.
*Ostracion.*
*Platyglossus.*
*Pomacentrus.*
*Diplodus.*
*Tylosurus* (long and short jawed).
*Balistes vetula.*
*Trachurus* (many).
*Pagellus.*
*Serranus.*

### *Porto Grande, St. Vincent, November* 11 *and* 12, 1889.

*Balistes.*
*Scorpæna.*
*Polynemus.*
*Trachurops* (26 specimens).
*Vomer.*
*Pagellus.*
*Epinephelus.*
*Chætodon.*
*Salarias atlanticus.*
*Gerres.*
*Teuthis.*
*Hypeneus* (29 specimens).
*Lutjanus.*
*Harengula.*
*Diplodus.*
*Diagramma.*
*Muræna.*
*Tylosurus.*

### *St. Paul de Loanda, December* 10–12, 1889.

*Tetrodon.*
*Trichiurus* (6 specimens).
*Caranx* (6 specimens).
*Pagellus.*
*Pristipoma* (9 specimens).
*Aprion* (3 specimens).
*Sphyræna.*
*Hemirhamphus* (6 *specimens*).
*Fodiator.*
*Brevoortia* (5 specimens).
*Harengula* (8 specimens).
*Lagocephalus* (4 specimens).
*Diplodus.*
*Mugil* (6 specimens).

### *Elmina, Ashantee.*

*Paralichthys* juv. (3 specimens).
*Periophthalmus* (several specimens).
*Chromis* (several specimens).
*Gerres* (9 specimens).
*Teuthis.*
*Caranx* (5 specimens).
*Lutjanus* (5 specimens).
*Mugil* (2 or more species, 21 specimens).
*Elops* (several specimens).
*Torpedo.*
*Gobius* (2 species, 5 specimens).
*Polynemus.*
*Chætodon* (2 specimens).
*Pristipoma* (several specimens).
*Serranus* (3 specimens).
*Carcharias*, juv.

### *Freetown, Sierra Leone.*

*Polynemus.*
*Cynoscion.*
*Brevoortia.*
*Caranx.*
*Larimus.*
*Chrysichthys.*
*Selene.*
*Albula.*

### *Cape Town, January* 18, 1890.

*Pomatomus.*
*Scomber colias.*
*Pagellus.*
*Trachurus.*
*Mugil.*

*From an old canoe at sea, N. Lat.* 6° 38′, *W. Long.* 13° 40′.

*Seriola* (13 specimens).

*St. Helena and Ascension, March* 1, 1890.

*Glyphidodon.*
*Salarias.*
*Julis.*

*Ascension Island, March,* 1890.

*Aluiera.*
*Balistes.*
*Glyphidodon.*
*Echeneis.*
*Pomacanthus.*
*Tylosurus* (2 specimens).

*S. Lat.* 2° 33′ 22″, *W. Long.* 23° 57′ 15″, *April* 14, 1890.—*From stomach of bonito.*

*Cephalacanthus* juv. (7 specimens).
*Tetrodon* (2 specimens).

### FISHES (FRESH-WATER SPECIES).

*Quanza River, Cunga, Angola, Africa.*

*Gobius.*
*Eleotris.*
*Chromis.*
*Hemichromis.*
*Cyprinoids* (juv.).
*Brachyalestes* (*Characinids*).
*Pellonula.*
*Cyprinoids* (young specimens, from pond Cunga.
*Bola.*
*Barbus* (several species).
*Mormyrops.*
*Mormyrops.*
*Ailia* (juv.).
*Clarias.*
*Eutropius.*
*Chrysichthys.*

MOLLUSKS.—The Department of Mollusks received a contribution of alcoholic and dry shells, of which the following is a list:

*Zonites cellarius* Müll, Fayal, Azores Islands.
*Patula rotundata*, Müll, Fayal, Azores Islands.
*Succinea? St. Helenæ* Lesson, Diana's Peak, St. Helena.
*Achatina balteata* Rve, Freetown, Sierra Leone.
*Achatina variegata* Roissy.
*Achatina perdix* Lam., Freetown, Sierra Leone.
*Achatina* (*Limicolaria*) *flammea* Brug, Freetown, Sierra Leone.
*Achatina* (*Limicolaria*) *numidica* Rve, Freetown, Sierra Leone.
*Bulimus* (*Pithohelix*) *ventricosus* Drap, Fayal, Azores Islands.
*Helix aspersa* Müll, Fayal, Azores Islands.
*Helix* (*Theba*) *pisana* Müll, Fayal, Azores Islands; Cape Town, Good Hope.
*Helix similaris* Fer., Green Mountain, Ascension Island.
*Helix Caldeirarum* M. and D., Fayal, Azores Island.
*Helix barbula* Charp, Fayal, Azores Islands.
*Siphonaria lineolata* Orb., Porto Grande, St. Vincent Island, Ashantee, West Africa.
*Siphonaria* sp., Porto Grande, St. Vincent Island.
*Aplysia* sp., Porto Grande, St. Vincent Island.
*Bulla striata* Brug, Porto Grande, Island St. Vincent.
*Terebra strigillata* Linn., Porto Grande, St. Vincent Island.
*Terebra Senegalensis* Lam., Porto Grande, St. Vincent Island.
*Terebra chlorata* Lam., Porto Grande, St. Vincent Island.
*Conus guinicacus* Hwass., Porto Grande, St. Vincent Island.
*Cancellaria similis* Sow., Porto Grande, St. Vincent Island.

*Oliva flammulata* Lam., Porto Grande, St. Vincent Island.
*Olivancillaria nana* Lam., Porto Grande, St. Vincent Island.
*Agaronia acuminata* Lam., Porto Grande, St. Vincent Island.
*Mitra plumbea* Lam., Porto Grande, St. Vincent Island.
*Mitra fusca* Swains, Fayal, Azores Islands.
*Mitra barbadensis* Gmel., Ascension Island.
*Leucozonia triserialis* Lam., Porto Grande, St. Vincent Island.
*Cominella limbosa* Lam., Porto Grande, St. Vincent Island; Cape Town, Cape of Good Hope.
*Tritonidea variegata* Gray, Porto Grande, St. Vincent Island.
*Columbella rustica* Linn., Fayal, Azores Islands; Porto Grande, St. Vincent Island.
*Columbella* (*Mitrella*) *cribraria* Lam., Porto Grande, St. Vincent Island.
*Murex* (*Phyllonotus*) *rosarium* Chemn., Porto Grande, St. Vincent Island.
*Murex* (*Ocinebra*) *angularis* Lam., Porto Grande, St. Vincent Island.
*Purpura hæmastoma* Linn., Fayal, Azores Islands; Porto Grande, St. Vincent Island; Elmina, Ashantee, West Africa.
*Purpura hæmastoma* Linn., var., Island of St. Helena.
*Purpura cingulata* Lam., Cape Town, Cape Good Hope.
*Purpura neritoidea* Linn., Porto Grande, St. Vincent Island.
*Sistrum nodulosum* C. B. Ad., Porto Grande, St. Vincent Island.
*Sistrum nodulosum* C. B. Ad., variety or new species, Porto Grande, St. Vincent Island.
*Ranella argus* Gmel., Cape Town, Cape Good Hope.
*Cypræa spurca* Linn., Porto Grande, St. Vincent Island.
*Strombus bubonius* Lam.
*Strombus fasciatus* Gmel.
*Strombus coronatus* Defrance, Porto Grande, St. Vincent Island.
*Cerithium atratum* Brug., Porto Grande, St. Vincent Island.
*Cerithium vulgatum* Brug., Porto Grande, St. Vincent Island.
*Planaxis lineatus* Da Costa, Porto Grande, St. Vincent Island.
*Vermetus Adansonii* Daudin., Porto Grande, St. Vincent Island.
*Vermetus interliratus* Stearns nom. prov. (perhaps should be separated and placed in a new genus), Porto Grande, St. Vincent Island.
*Littorina striata* King, Fayal, Azores Islands; Porto Grande, St. Vincent Island.
*Littorina pulchella* Dkr., Porto Grande, St. Vincent Island; Ashantee.
*Littorina cingulifera* Dkr., no locality, probably Cape of Good Hope.
*Littorina scabra* Linn, Ashantee, West Africa.
*Tectarius miliaris* Q. and G., Ascension Island.
*Fossarus ambiguus* Linn., Porto Grande, St. Vincent Island.
*Lanistes* sp., Cunga, West Africa.
*Hipponyx barbata* Sow., Porto Grande, St. Vincent Island.
*Trochita radians* Lam., Porto Grande, St. Vincent Island.
*Natica forata* Rve., Fayal, Azores Islands.
*Ianthina communis* Lam., Fayal, Azores Islands; Porto Grande, St. Vincent Island.
*Pyramidella dolabrata* Linn., a variety of this, possibly a new species; Porto Grande, St. Vincent Island.
*Nerita neritinoides* Rve., Ashantee, West Africa.
*Nerita Ascensionis* Chem., Ascension Island.
*Phasianella Capensis* Dkr., Porto Grande, St. Vincent Island.
*Phasianella pulla* Linn., Porto Grande, St. Vincent Island.
*Phasianella neritina* Dkr., Cape Town, Cape Good Hope.
*Pachypoma tuber* Linn., ?, habitat probably Barbadoes.
*Osilinis Tamsi* Dkr., Porto Grande, St. Vincent Island.
*Gibbula Nassaviensis* Chemn.
*Gibbula umbilicaris* Linn., var., Porto Grande, St. Vincent Island.
*Oxystele sagitifera* Lam., Cape Town, Cape Good Hope.

*Haliotis striata* Lam., Fayal, Azores Islands.
*Fissurella alabastrites* Rve., Porto Grande, St. Vincent Island.
*Fissurella mutabilis* Sow., Cape Town, Cape Good Hope.
*Patella Moreleti* Drouet.
*Patella rustica* Linn., var. and junior, Fayal, Azores Islands.
*Patella Gomesii* Drouet.
*Patella rustica* Linn., Fayal, Azores Islands.
*Patella Argenvillii* Krauss, Island St. Helena; Cape Town, Cape Good Hope.
*Patella plumbea* Lam., Porto Grande, St. Vincent Island.
*Patella plicata* Born., Porto Grande, St. Vincent Island.
*Patella Baudonii* Drouet, Cape Town, Cape Good Hope.
*Patella oculus* Born., Cape Town, Cape Good Hope.
*Patella cochlear* Gmel., Cape Town, Cape Good Hope.
*Patella pruinosa* Krauss, Cape Town, Cape Good Hope.
*Patella granularis* Linn.
*Patella denticulata* Mart., Cape Town, Cape Good Hope.
*Chiton* (*Stenoplax*) *purpurascens* C. B. Ad., Barbadoes.
*Chiton cyaneopunctatus* Krauss.
? *Chiton capensis* Gray, var., Cape Town, Cape Good Hope.
*Spirula fragilis* Lam., Fayal, Azores Islands.
*Octopus* sp., Ascension Island.
*Sepia officinalis* Linn., St. Paul de Loanda, West Africa.
*Ostrea mordax* Gould, Ascension Island.
*Ostrea frons* Lam., Porto Grande, St. Vincent Island.
*Spondylus gaederopus* Linn., Porto Grande, St. Vincent Island.
*Spondylus imbutus* Rve., Ascension Island.
*Pecten miniaceus* Rve., Fayal, Azores Islands.
*Isognomon perna* Linn.
? *Isognomon dentiferus* Krauss, Ascension Island; Porto Grande, St. Vincent Island.
*Mytilus atropurpureus* Dkr., Fayal, Azores Islands.
*Mytilus ovalis* Lam., Porto Grande, St. Vincent Island.
*Mytilus edulis* Linn. ?, Cape Town, Cape Good Hope.
*Mytilus Magellanicus* Chemn., Cape Town, Cape Good Hope.
*Lithophagus aristatus* Sol.
*Lithophagus caudigerus* Lam., Porto Grande, St. Vincent Island.
*Dreissensia Africana* Van Ben., Ashantee.
*Arca Noae* Linn., Porto Grande, St. Vincent Island.
*Arca tetragona* Poli.
? *Arca navicularis* Brug., Ascension Island; Porto Grande, St. Vincent Island.
*Arca holoserica* Rve, Porto Grande, St. Vincent Island.
*Arca rhombica* Born., Porto Grande, St. Vincent Island.
*Arca senilis* Gmel., Porto Grande, St. Vincent Island; Freetown, Sierra Leone; Ashantee.
*Pectunculus violescens.*
*Pectunculus stellatus* Lam., Porto Grande, St. Vincent Island.
*Unio Gaboonensis* Kuster, Cunga.
*Cardita ajar* Brug., Porto Grande, St. Vincent Island.
*Cardium ringens* Chemn., Porto Grande, St. Vincent Island; Ashantee.
*Venus rugosa* Desh., Porto Grande, St. Vincent Island.
*Venus striata* Gray., Ashantee.
*Callista chione* Linn., Fayal, Azores Islands.
*Dosinia Orbignyi* Dkr., Porto Grande, St. Vincent Island.
*Dosinia isocardia* Dkr., Porto Grande, St. Vincent Island.
*Dosinia torrida* Rve.
? *Dosinia orbignyi* Dkr., Porto Grande, St. Vincent Island.

*Dosinia fibula* Rve., Porto Grande, St. Vincent Island.
*Diplodonta rotundata* Müll., Fayal, Azores Islands.
*Donax rugosus* Linn., Porto Grande, St. Vincent Island; St. Paul de Loanda.
*Mactra Adansoni* Phil., Porto Grande, St. Vincent Island.
*Loripes lacteus* Linn., Porto Grande, St. Vincent Island.
*Tellina Madagascariensis* Gmel., Porto Grande, St. Vincent Island.
*Tellina incarnata* Linn., Fayal, Azores Islands.

INSECTS.—The Department of Insects received a collection from southern and western Africa. It arrived in very good condition, the lepidoptera packed in papers, and the remainder of the material in alcohol. The collection comprised some 250 species, most of them represented in fair series and representing the different orders in the following proportions:

Lepidoptera (40 species).
Coleoptera (74 species).
Orthoptera (46 species).
Pseudoneuroptera (10 species).
Hemiptera (19 species).
Hymenoptera (25 species).
Diptera (7 species).
Myriapoda (10 species).
Arachnida (12 species).

The Museum collections are poor in the fauna of this region, and nearly all the species were heretofore unrepresented. The Hymenoptera have been sent to Mr. W. F. Kirby, of the British Museum; the Orthoptera to M. Henri de Saussure, of Geneva, Switzerland; the Hemiptera to M. A. Montandon, of Bucharest, Roumania, and most of the Coleoptera to Dr. David Sharp, of Dartford, England. The majority of the Lepidoptera were determined in Washington, thanks to Mr. Roland Trimen's recent monographs of South African Lepidoptera. The remainder of the Lepidoptera have been sent to Rev. W. J. Holland, of Pittsburgh, Pennsylvania. The Myriapoda are in the hands of Prof. L. M. Underwood, of Syracuse, New York; the Arachnida have been referred to Dr. George Marx, of Washington, and the few Diptera have not yet been disposed of.

The following statement has reference to the Lepidoptera and Coleoptera, and three species of Hemiptera, which have been determined in Washington:

### LEPIDOPTERA.

#### Suborder RHÖPALOCERA.

#### Family *Nymphalidæ*.

*Danais chrysippus* L., var. *dorippus* Klug.
Roland Trimen, South African Butterflies, vol. I, London, 1887; 9 specimens from Congo, and 2 from St. Helena.
*Danais chrysippus* L., var. *alcippus* Cram.
Trimen, *loc. cit.*, 1 specimen, Freetown.
*Danais plexippus* Fab., 2 specimens, Fayal, Azores.
*Acræa horta* L.
Trimen, *loc. cit.*, 9 specimens, Cape Town.
*Acræa eucedon* L.
Trimen, *loc. cit.*, 11 specimens, Congo.
*Acræa serena* Fab., var., 1 specimen, Congo.

*Pyrameis cardui* L., 4 specimens, St. Helena.
*Precis amestris* Dru., 2 specimens, Freetown.
*Nephis marpessa* Hopffer.
    Trimen, *loc. cit.*, 1 specimen, Freetown.
*Diadema misippus* L.
    Trimen, *loc. cit.*, 3 specimens, St. Paul de Loanda; 1 specimen, Congo.
*Hamanumida dædalus* Fab.
    Trimen, *loc. cit.*, 1 specimen, Freetown.
*Harma cœnis* Dru., 1 specimen, Freetown, Sierra Leone.

### Family *Papilionidæ*.

*Terias æthiopica* Trimen.
    Trimen, South African Butterflies, vol. III, London, 1889; 1 specimen, Sierra Leone; 4 specimens, Congo; 3 specimens, Freetown.
*Mylothris chloris* Fab.
*Mylothris ruppellii* Koch.
    Trimen, *loc. cit.*, 2 specimens ♂ and ♀, Freetown.
*Mylothris poppea* Cram., 1 specimen ♀, Freetown.
*Pieris gidica* Godart.
    Trimen, *loc. cit.*, 8 specimens ♂ and 1 specimen ♀, Congo.
*Pieris severina* Cram.
    Trimen, *loc. cit.*, 2 specimens ♂ and ♀, Porto Grande; 2 specimens ♂ and ♀, Congo.
*Colias electra* L.
    Trimen, *loc. cit.*, 1 specimen ♀, Cape Town.
*Herpænia eriphis* Godart.
    Trimen, *loc. cit.*, 1 specimen ♀, Congo.
*Teracolus evippe* L.
    Trimen, *loc. cit.*, 2 specimens ♂, St. Paul de Loanda; 1 specimen ♂, Porto Grande, Cape Verde Islands.
*Teracolus omphale* Godart.
    Trimen, *loc. cit.*, 2 specimens, St. Paul de Loanda.
*Teracolus vesta* Reiche.
    Trimen, *loc. cit.*, 1 specimen, St. Paul de Loanda.
*Papilio demoleus* L.
    Trimen, *loc. cit.*, 2 specimens, Congo; 1 specimen, Elmina, Gold Coast.

### Family *Hesperidæ*.

*Pterygospidea flesus* Fab.
    Trimen, *loc. cit.*, 1 specimen, Freetown; 1 specimen, Elmina, Gold Coast.

## Suborder HETEROCERA.

### Family *Zygænidae*.

*Euchromia fulvida* Butler.
    Trans. Ent. Soc. London, 1888, p. 112; 2 specimens, Freetown.
*Euchromia splendens* Butler.
    Loc. cit., p. 113; 1 specimen, Freetown.
*Euchromia sperchius* Cram.
    Three specimens, Freetown.

### UNDETERMINED.

Eleven specimens of Diurnals and nine specimens of Heterocera.

## COLEOPTERA.

*Calosoma rugosum* De Geer.
One specimen, Porto Grande, Cape Verde Islands.
*Anthia 10-guttata* L.
One specimen, Cape Town.
*Cybister senegalensis* Aube.
Sharp's Monograph No. 1145, 1 specimen, Congo.
*Cybister tripunctatus* Ol.
Sharp's Monog. No. 1140, 31 specimens, St. Paul de Loanda.
*Cybister filicornis.*
Sharp's Monog. No. 1129, 6 specimens, Congo.
*Eretes sticticus* L.
Sharp's Monog. No. 1095, 5 specimens, St. Paul de Loanda.
*Dineutes subspinosus* Klug.
One specimen, St. Paul de Loanda.
*Dineutes aereus* Klug.
One specimen, Freetown, Sierra Leone.
*Berosus cuspidatus* Erichs.
Wiegm. Arch., 1843, 1 specimen, Congo.
*Goerius olens* Müll.
Two specimens, Fayal, Azores.
*Gymnopleurus virens* Er.
Fifteen specimens, St. Paul de Loanda.
*Oryctes boas* Fab.
One specimen ♂, Elmina, Gold Coast. One specimen ♀, St. Paul de Loanda.
*Temnorhynchus diana* Beauv.
One specimen, Congo.
*Pachnoda marginata* Dru.
Fifteen specimens, Elmina, Gold Coast.
*Heterorrhina monoceros* Gory et Perch.
Two specimens, St. Paul de Loanda.
*Phryneta spinator* Fab.
One specimen, Congo, 58 species unnamed.

## HETEROPTERA.

*Sphaerocoris argus* Dru.
Two specimens, Congo.
*Sphaerocoris ocellatus* Klug.
Forty-nine specimens, and three specimens larva, Congo.
*Hotea gambiæ* Fab.
Two specimens, Congo.

GEOLOGY.—The Department of Geology received a specimen of chalcopyrite from Ascension Island; one specimen of shell limestone from the Barbadoes, and several pieces of lava from Porto Grande and Horta, Fayal Island, Azores. So far as can be determined by simple microscopic examination, these rocks are ordinary basalts. A study of thin sections with a microscope might lead to different conclusions, but these can not be well prepared at present, owing to the unusual pressure in other directions. This work will, however, be undertaken at some future time.

The Department of Marine Invertebrates received a collection of crustaceans, echinoderms, worms, bryozoans, sponges, actinians, and nullipore corals, from Azores and Cape Verde Islands.

The Department of Comparative Anatomy received a few specimens of alcoholic birds for skeletons.

The Department of Birds received a collection of dry and alcoholic birds, a report upon which will be furnished hereafter.

A collection was received by the Department of Botany, a report upon which will be furnished by the curator as soon as practicable.

On April 10, 1890, Mr. Brown accompanied an exploring expedition sent by the British South African Exploration Company, with a view to opening up the country for settlement, to Matabela and Mashona lands, about 2,000 miles from Cape Town, and near the Zambesi River. The expedition consisted of two hundred white men and four hundred negroes. Excellent facilities for collecting were furnished by Mr. Johnson, the director of the expedition, who also kindly offered to send specimens of natural history intended for the National Museum free of charge to Kimberly, by the company's ox teams. The Government railway has also offered to carry collections free from Kimberly to Cape Town. Mr. Linley, of the South African branch of the New York Equitable Assurance Association in Cape Town, kindly volunteered to attend to the interests of the National Museum in Cape Town, and arrangements have been made with the taxidermist of the South African Museum in Cape Town to repack the specimens for shipment to the United States.

Incidentally the Museum has received, through Mr. Brown, several collections of African material from private individuals. Rev. G. H. R. Fisk presented an excellent series of living tortoises and some chameleons. Mr. J. H. Brady contributed a series of South African coleoptera. Mr. P. McOwan, director of the Botanical Garden at Cape Town, sent to the Museum bulbs of *Arctopus echinatus*, capsules of *Unaria procumbens*, *Unari Burchellii*, and *Rogena longiflora*. Mr. Frye, of Cape Town, presented, through Prof. Cleveland Abbe, a collection of natural history specimens, including a series of antelope horns. The superintendent of the Kimberly Diamond Mines presented to the Smithsonian Institution some specimens of the rocks in the gold mines. Dr. C. H. White, of the United States steamer *Pensacola*, collected insects for the Museum at Cape Ledo. Offers to exchange birds and mammals were also proposed.

Reference was made in the report for 1889* to the valuable collections obtained in Morocco for the National Museum by Mr. Talcott Williams, and a preliminary report upon the work which he accomplished was published in the same place. It was hoped that it would be possible to publish in this report a full statement of what has been accomplished. This can not be done until the specimens have been unpacked and distributed in the Museum and a list made of them. Unfortunately Mr. Williams has not yet been able to attend to this.

The following information relating to his work has been gathered from letters received from Mr. Williams since the report for 1889 went to press:

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* pp. 144-146.

Five sheets of a Berber manuscript were purchased. These manuscripts are very rare. Neither the Madrid Royal Library nor the British Museum owns one, and the Bibliothèque Nationale at Paris has only two. These sheets are portions of one of a number of translations of Moslem law into the Berber, made probably in the thirteenth century. During the Arab renaissance, which attended the founding of the Sherifian dynasties, these Berber books were destroyed, on the ground that the law could be written only in Arabic.

The botanical collection consists of about 300 plants, all of which, except 4 or 5, are phenagamous. Mr. Williams made no effort to identify the species, but has expressed his willingness, after this has been done and the results published, to contribute a paper indicating their distribution and the changes observed in the fauna of the region while passing from one elevation or one formation to another. Fossils were obtained at Azigen, near Wazan, a place whose geological horizon has not before been determined; concretions from Fez from the only formation near the place; fossils from encrinal limestone at Volubilis, confirming previous conclusions; and a number of recent fossil shells from Wady Ghifra, near Azila, extending the area of the quaternary formation already observed near Tangier. These fossils add nothing particularly new to the observations already made by Mourlon, Maw, and Velain, but, since so few fossils have been found in Morocco, these will be valuable.

A valuable collection of ethnographical material was gathered in Morocco. Mr. Williams states that for $100 he can have delivered in Washington the complete household equipment of a city and village family.

The costume of a city woman of Fez, a villagers costume, and also the costume of a man and woman of the mountain, representing both the Berber and mountain villagers, were obtained. The city male and female costumes of Tangier are already in the Museum. The male costume in Fez and Tangier is similar, but the female costume differs in many ways. The Jewish costume of northern Morocco is one of the most elaborate in the world. It is a most interesting survival and rapidly growing rare. The complete costume, with its heavy embroidery, costs $250. This estimate allows for paste jewelry in the costume.

Northern Morocco is inhabited by four, if not five, races—the Moor proper, often of primitive Arab, Berber, or Spanish descent; the Arab, either wandering or sedentary in villages and cities; the Berber, or Riff, in villages, in colonies in the cities, and in some cases, as at Tangier and Tetuan, intermingled with the urban population; and the Jew, for the most part Spanish, inhabiting a separate quarter in each city.

The pottery collection was made with the special design to include all the wares in ordinary use between Tetuan and Fez. The pottery of Spain and Morocco are closely related, and Spanish patterns are still in use at Fez. Between Spain and Persia are located about a score of pottery centers, which show the steps of development from the old Spanish and Moorish patterns.

Mr. Williams suggests the wisdom of beginning at once a collection of local folk pottery, the varieties of which are fast becoming extinct, owing to the introduction of machinery-made wares. It would probably cost from $1,000 to $1,200 to obtain a complete representation of local pottery all over the Mediterranean region. The country lying between Persia and Burmah represents another pottery basin. No European museum has endeavored to make a collection of local folk pottery now in use in these countries save one or two in Germany, and, while such a collection would cost but a small sum now, it will soon become impossible to acquire one at any price. Mr. Williams suggests the following places from which to purchase: Granada, Valencia, Barcelona, Catalonia, two points in Sicily, Rhodes, Dardanelles, Damietta, Upper Nile, Brusa, Damascus, Aleppo or Oorfa, Diarbekir, Bagdad, Erzeroum, Tabreez, Ispahan, Shiraz, and some inland points in Algeria, Sfax, Tunis, Tripoli, and Benghazi. The collection should be made under careful direction, so as to procure pieces of like use, but of different pattern.

Twenty-four musical instruments were secured, among them six varieties of the gimbrede, two oods, a rabab, a canoon, three varieties of the shebab, two ghitas, a zemmar, a lira, four varieties of drum, two varieties of castanets, and some whistles. Photographs illustrating the manner of playing these instruments were also obtained. Mr. Williams has kindly offered to prepare a short paper, giving the name and parts of each instrument, its habitat and manner of playing, its compass, and a comparison between it and other oriental instruments.

Articles illustrating light, fire, and the industry of comb-making and numerous household utensils were secured.

It may be safely asserted that this collection, taken as a whole, is one of the most interesting of its kind that the Museum has ever received, and the sincere thanks of the Smithsonian Institution are due to Mr. Williams for the energetic and intelligent manner in which he has accomplished his mission.

Dr. W. H. Rush, of the nautical school ship *Saratoga*, has consented to collect mollusks and other marine invertebrates during his expedition to the Azores, Madeira, and the English Channel. Two dredges, courteously lent by Col. Marshall McDonald, U. S. Commissioner of Fisheries, have been placed in his hands to aid him in his work of collecting for the National Museum. The attention of Dr. Rush has been especially called to the desirability of obtaining sea-urchins, star-fishes, coral, and crustaceans.

Mr. J. B. Iddings, of the U. S. Geological Survey, has expressed his willingness to bear in mind the interests of the National Museum, as far as geological material is concerned, during his visit to Vesuvius, Lipari, Stromboli, Etna, and other interesting localities.

Mr. E. M. Aaron, Secretary of the Executive Committee of the American Entomological Society, has, through Prof. C. V. Riley, announced his intention to visit Jamaica, and perhaps Vera Cruz, for the purpose of making collections of insects. In a letter to Professor Riley in reference to his plans, he expresses the general hope that he may be able to present to the National Museum a part of his collections. It was not possible to offer Mr. Aaron a commission to collect for the Museum. He has, however, been informed that biologic material in any orders where the life history of each species is represented, will be acceptable, as well as any good specimens of species of the families *Coccidæ*, *Psyllidæ*, and *Aleurodidæ*, and of all families of parasitic Hymenoptera.

Mr. C. R. Orcutt, of San Diego, California, who since 1880 has presented to the National Museum about thirty collections, including specimens of reptiles, mammals, insects, mollusks, birds, fossils, and ethnological objects, has been furnished with copper-tanks, jars, and alcohol to be used in preserving specimens which he may collect during his expedition to the Colorado desert and the Gulf of California, for which regions he started on January 1, 1890, with the expectation of spending four months in collecting specimens.

Mr. A. J. Miller, of Evansville, Indiana, who in a letter dated July 8, 1889 states that he has discovered a buried city in Honduras, has invited the Smithsonian Institution to join with him in carrying on the work of exploration and excavation. It was not possible to furnish the desired sum of money. Mr. Miller was informed, however, that the National Museum would be glad to purchase from the antiquities obtained from the ruins such objects as might be deemed desirable for addition to the collections.

Mr. Henry W. Elliott, for many years connected with the Alaska Commercial Company, has offered to collect specimens of fur-seal, fishes, and marine invertebrates during his visit this summer to the Seal Islands of Alaska upon business connected with the United States Government. His offer has been accepted. Mr. Elliott left for Alaska on April 24. Through the courtesy of the Secretary of the Treasury, arrangements have been made for shipping a supply of alcohol to the Seal Islands for Mr. Elliott's use in preserving specimens. Mr. William Palmer, of the National Museum, has been detailed to accompany Mr. Elliott. In the next report will be published a list of specimens obtained by Messrs. Elliott and Palmer.

### COLLECTOR'S OUTFITS.

With a view to facilitating the work of those who have expressed their willingness to collect specimens for the Museum, as well as those who have been sent out as collectors by the Museum, outfits of apparatus, tanks, alcohol, etc., have been furnished. During the year 1889–'90 the following collectors have been supplied:

1889.

*October* 1.—Mr. William Harvey Brown, of the National Museum, who was appointed naturalist on the United States Eclipse Expedition to South Africa, was supplied with a large outfit, including tanks, alcohol, jars, oil, linen, tools, guns and ammunition, to be used in collecting natural history specimens. Several collections of fishes, shells, and marine invertebrates from the Azores have been received.

*November* 12.—Mr. Frank Burns, of the U. S. Geological Survey, kindly offered to collect shells and birds in Florida. An outfit has been sent to him, including tanks, alcohol, and shellac. One woodpecker, 8 specimens of shells from Chattahoochee Station, and 21 shells from the Kitchen midden at Alum Bluffs have been received.

*December* 17.—Mr. John C. Tolman, collector of customs at Kadiak, Alaska, has expressed his willingness to collect birds, shells, and plants in that vicinity for the National Museum. He has been supplied with cotton, dissecting-tools, etc. Unfortunately, however, owing to ill-health, he has been compelled to defer his work. - He has, therefore, placed the outfit in the hands of Mr. W. J. Fisher, who has been for many years a generous collector for the Smithsonian Institution. Mr. Fisher has been requested to collect ethnological specimens, and to endeavor to complete, as far as possible, our collections of the fauna and flora of Alaska. Mr. Tolman intends, however, to send a collection of bird's skins.

*December* 27.—Dr. John I. Northrop, of Columbia College, New York, who sailed in January for the Bahama Islands, has kindly offered to present a duplicate series of specimens of marine invertebrates and fishes from the Bahamas to the Smithsonian Institution. An outfit, including tanks and tags, has been sent to him. He expects to collect star-fishes, sea-cucumbers, small corals, and shore species of fishes.

1890.

*January* 6.—Mr. C. R. Orcutt, of San Diego, California, having arranged for an expedition to the Colorado River and the Gulf of California, kindly offered to collect shells, fishes, reptiles, and plants from that region. An outfit, consisting of tanks, tank-boxes, alcohol, butter-jars, padlocks, and a small seine, was sent to him at Yuma, Arizona. On September 23, 3 cans, containing 31 specimens of reptiles, snakes, and lizards, were received from him. Mr. Orcutt has already donated 26 collections to the National Museum.

*January* 7.—Rev. F. Gardiner, jr., who sailed from Newport News, Virginia, for the West Indies, in February, was supplied with tanks, tank-boxes, alcohol, tin-tags, etc., for the purpose of collecting natural-history specimens. Two tank-boxes, containing alcoholic specimens of fishes, have already been received.

*January* 25.—An outfit, including tanks, tank-boxes, alcohol, etc., has been forwarded to Mr. J. Francis Le Baron, Superintendent of the Nicaragua Canal Construction Company, at San Juan del Norte, Nicaragua, for the collection of reptiles and insects. Several bottles of alcoholic specimens, principally snakes and insects collected in Nicaragua and Costa Rica, have been received. Mr. Le Baron has for more than twenty years taken a great interest in the welfare of the National Museum, having since 1867 been a contributor to the collections from the New England States and Florida. Since the transmission of the outfit, the Museum has been informed that Mr. Le Baron has severed his connection with the company. His outfit has been turned over to Mr. Menocal, who has kindly consented to carry on the work of collecting specimens.

*February* 14.—Mr. C. H. Eigenmann, of San Diego, California, contemplating a journey to Wood's Holl, offered to spend two or three weeks in collecting natural history specimens between Yuma and St. Louis, along the Texas Pacific and Iron Mountain routes, and on his return between New Orleans, Houston, San Antonio, and Northeastern Mexico. A collecting outfit was forwarded to him. A tank has been received from him containing alcoholic specimens of fishes, mollusks, crabs, and shrimps.

*March* 13.—Mr. Henry D. Woolfe, who went to Point Barrow, Alaska, in the employment of the Pacific Steam Whaling Company, has kindly offered to continue to collect birds' skins, insects, fossils, mammals, minerals, fishes, and ethnological specimens. An outfit has been forwarded to him, in care of the Pacific Steam Whaling Company, in San Francisco. He has already made large collections for the National Museum.

*April* 24.—Dr. William H. Rush, of the United States Naval Hospital, Philadelphia, Pennsylvania, who accompanied the school ship *Saratoga* on its recent trip to the Azores and the English coast, has offered to make a collection of fishes for the National Museum. For this purpose dredging-nets have been sent to him.

*April* 25.—The collecting outfit which had been placed at the disposal of Ensign W. L. Howard, has been transferred to Mr. Henry W. Elliott, to be used for the preservation of the smaller specimens obtained during his visit to Alaska. Mr. Elliott was also supplied with a large outfit, including cotton-batting, alum, arsenic, etc. Twenty-two packages of specimens have been received, but have not yet been examined.

# SECTION II.

## REPORTS OF THE CURATORS OF THE U. S. NATIONAL MUSEUM UPON THE PROGRESS OF WORK DURING THE FISCAL YEAR ENDING JUNE 30, 1890.

# REPORT ON THE DEPARTMENT OF ETHNOLOGY IN THE U. S. NATIONAL MUSEUM, 1890.

By OTIS T. MASON, *Curator.*

The first three months of the fiscal year were spent in studying anthropological collections in Europe, and especially at the Paris Exposition, during the sessions of the Tenth International Congress of Anthropology and Prehistoric Archæology.

In the British Museum a large amount of new space has been added to the Department of Ethnology by the removal of the Natural History Department to South Kensington. The method of installation is ethnographic, or, more properly, topographic. It is not possible here to enlarge upon the richness of this material. The method of cataloguing is worthy of imitation. Each specimen is accompanied by a large-sized catalogue card, which bears, in addition to ample description and identification, a good drawing. Mr. C. H. Reede, the assistant keeper, is preparing a new edition of "Notes and Queries for Anthropological Observers," to be published by the British Association for the Advancement of Science. This little manual is put into the hands of travelers, missionaries, and government officials who journey in foreign parts. The first edition elicited much material and information for the British museums. My stay at the College of Surgeons was brief. The removal of Professor Flower to South Kensington and the absence of Dr. Garson from the city deprived me here of that intelligent guidance which reveals the genius of a museum. At South Kensington, as is well known, the arrangement of material is topical in its primary concept, the whole being officially connected with the English system of technical instruction. As soon as an idea, a series of objects belonging to a class or to a country, or to both, is sufficiently worked out, the material is placed on exhibition in excellent shape, and a hand-book catalogue is prepared. This system is worthy of imitation, and many of its features already appear in the U. S. National Museum.

The unit system of interchangeable tablets, trays, boxes, sliding drawers, and screens is the perfection of installation. In carrying out its plan the Kensingston Museum does not scruple to use copies and pictures of type forms which are not procurable, and large series of electrotype and other reproductions are furnished to other establishments. I had the great pleasure of examining the art work of prize scholars in the public schools of Great Britain, set up in a large gallery at Kensington. I must not neglect to mention the India Museum, which is very near to the South Kensington, containing the spoils of the Orient. My visit to this charming place was made very instructive and delightful by the courtesy of the keeper, Mr. C. Purdon Clarke. In a collection devoted to a single region, the national as well as the ethnic idea is sufficiently prominent, *primâ facie.* The keeper, therefore, has only the notion of effect to study. In the India Museum it is found most convenient to arrange by material and style of treatment; and the visitor, therefore, especially the expert and the specialist, may study jade or metal or textile without embarrassment or distraction. The plan of the Metropolitan Museum of Art in New York is somewhat similar to that of this great collection.

The Tower of London is now a great museum devoted to the custody of the crown jewels and of an unparalleled collection of armor and small arms. In this place, as in many other European galleries, the history of the building adds dignity and interest to the material. But in the construction and furnishing of new establishments little will be found here to imitate. The illumination, stairways, convenience of floor space, cases, and fixtures are all as bad as they could well be for purposes of exhibition.

The Anthropological Institute holds its sessions in the building of the Zoölogical Society, but the month of August found the members all scattered, so that the curator had small opportunity for studying the practical methods of the society.

During my stay in London I paid several visits to Prof. A. H. Keane, for the purpose of inspecting his summary of ethnology. Such a synopsis is most desirable, and I am extremely anxious to see Professor Keane's work in print.

It was my pleasure to spend a day in the anthropological portion of the Oxford Museum. A galleried annex to the natural history building has been fitted up for the reception of the Lane-Fox collection. In this museum can be seen the best example of a topical arrangement, the purpose being in each alcove or range to show how the inventive genius of man may have passed from one stepping-stone to another in every type of tool, or weapon, or art-production.

Three motives impelled the curator to visit Paris in the month of August; namely, the Exposition, the Congresses, and the resources of anthropological study of permanent value there. The science of anthropology is well organized in Paris, both as regards resources, such as museums, laboratories, libraries, journals, instrument factories, and publishing-houses, and as regards men and organizations. The museums represent the whole science of man's natural history, to wit:

Musée St. Germain, devoted to the palæolithic, neolithic, bronze, and early Christian period of France down to the tenth century.

Musée Cluny, devoted to Mediæval France.

Musée du Trocadéro, devoted to the races of men and their arts. It is the ethnographic museum of Paris, corresponding to the British Museum, and that of Copenhagen.

Musée Carnavalet, devoted to the history of Paris.

Musée Guimet, devoted to the history of religion.

Musée du Louvre, devoted to classic art and archæology, painting, ceramics, metallurgy, and art decorations in precious materials.

Musée d'Artillerie, arms and armor.

Conservatoire des Arts et Métiers, repository of all that relates to machinery and human industry.

Conservatoire de Musique, in which the musical apparatus of the world is displayed.

The Jardin des Plantes, presided over by M. de Quatrefages, the Nestor of French scientists, affords the best opportunity of studying the comparative anatomy of man and his relations to geological history. Here are to be seen celebrated crania, the Naulette jaw, and skeletons of the extinct mammals found associated with human remains, and all that concerns human technique in vegetal substances. The result of the work of M. Gaudry among the Tertiary mammals is here displayed.

In a separate building in the Latin quarter are the Musée Broca, the Laboratoire d'Anthropologie, the Ecole d'Anthropologie, and the Société d'Anthropologie. The first three constitute the Institut d'Anthropologie. (La Société, l'École et le Laboratoire d'Anthropologie de Paris à l'Exposition Universelle de 1889, Paris—Imprim. Réunies.)

The vast collections of literature amassed by Broca, by the Société d'Anthropologie and in connection with the Institut d'Anthropologie, are united in a single library of great value in the hall of the Société d'Anthropologie. In all the museums above enumerated are excellent libraries of books and portfolios, and guide-books germane to their respective collections.* There is no better place to study the entire body of literature relating to the natural history of man than in the Bibliothèque Nationale. The publishing-houses of Masson pour forth a constant stream of new books upon the same subject, and even upon the bridges of Paris one may provide himself, at moderate cost, with an excellent collection of rare and useful books relating to man.

The Exposition and the Congresses may be mentioned in conjunction. A detailed statement in regard to them will be deferred until after the account of the perpetual resources of Paris, because to the eye of the anthropologist the whole Exposition seemed to have been arranged for his special pleasure and profit.

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* The publications are: Bulletins de la Société d'Anthropologie de Paris; L'Anthropologie, founded in 1889 by the union of Matériaux, Revue d'Anthropologie, and Revue d'Ethnographie; Annales du Musée Guimet; Revue de l'Histoire des Religions. Mélusine; Revue des Traditions Populaires: Criminologie; Revue de Linguistique.

There is no doubt that the institutions of Paris above described, and the men most concerned in them, had a commanding influence in shaping and arranging much of the great Exposition. Owing to this living connection between men and things, the glory of the French Exposition, which elevated it above its predecessors, consisted largely in its Congresses, one hundred and twenty of which were held between May and October. Every one of them was, to the writer's mind, intensely anthropological, relating to the history and the natural history of invention. But, omitting all of those that were especially practical, there was a series which covered the whole ground of the science of man, his embryology, anatomy, anthropometry, physiology, psycho-physics, psychology, language, race, primitive art, institutions, customs, laws, philosophy, conduct, religion, and distribution in time and place, as the following titles will show:

*June* 24-29.—Protection of Works of Art and of Monuments.

*August* 4-11.—Hygiene and Demography.

*August* 5-11.—Physiological Psychology.

*August* 8-15.—French Association for the Advancement of Science.

*August* 10-17.—Criminal Anthropology.

*August* 19-26.—Anthropology and Prehistoric Archæology, Ethnography, Popular Traditions.

At least one year before the 1st of September, 1889, the executive committee of the Congrès International d'Anthropologie et d'Archéologie Préhistorique sent circulars to anthropologists inviting them to attend the session in Paris and begging their coöperation. In the spring of 1889 the committee of the Exposition on Congresses assigned the days and places of meeting for each, chiefly in the rooms of the university and colleges in the Latin quarter, because the regular lectures would be intermitting during the vacation.

The committee of the Congress of Anthropology was then able to send out a definite programme. The plan of procedure, after the usual routine of organization, was to hold sessions in the University, and then adjourn each day to one of the celebrated collections of the city or to one of the anthropological sections of the great Exposition under the guidance of some one perfectly familiar with the material.

The questions discussed in the Congress were the following:

(1) Erosion and filling of valleys and filling of caverns, both in their relation to the antiquity of man.

(2) Periodicity of glacial phenomena.

(3) Arts and industries in the caverns and in the alluvium. Value of paleontological and archæological classifications applied to the quaternary epoch.

(4) Chronological relations between the ages of stone, bronze, and iron.

(5) Relations between the civilizations of Hallstadt and other stations in Daubes and those of Mycenæ, Tirhyns, Issarlik, and the Caucasus.

(6) Critical examination of crania and other human bones alleged to have been found in the quaternary during the last fifteen years. Ethnic elements peculiar to the different ages of stone, bronze, and iron in central and western Europe.

(7) Ethnographic survivals which throw light upon the social condition of primitive populations in central and western Europe.

(8) How far do archæologic or ethnographic analogies authorize the hypothesis of prehistoric consanguinity or of migrations?

The thoroughness of this work may be imagined from the following list of guides and lecturers:

Jardin des Plantes, MM. Quatrefages, Gaudry, and Hamy; Palais de Justice, M. Alphonse Bertillon; Laboratoire d'Anthropologie, MM. Manouvrier and Chudzinski; Musée St. Germain, MM. Bertrand Mortillet, Reinach; Chellian Collection, M. d'Acy: Collections in the Exposition, MM. Topinard, Cartailhac, Piette, Valdemar Schmidt, Marquis de Nadaillac.

Besides the anthropological exhibits in the Palais de l'Industrie, much material relating to our special subject was to be seen in the colonial and foreign pavilions, such as those of Finland, Mexico, Ecuador, Nicaragua, Venezuela, Colombia, Hawaii, Portugal, New Guinea, Transvaal, Algeria, Tunis, Anam and Tonkin, French India, Tahiti and French Oceanica, New Caledonia, Guiana, Senegal, Gabon, Congo, Guadeloupe (Guesde), Cambodia, Cochin China, and Java.

A portion of the space near the Invalides was set apart for the exhibition of African and Franco-Indian natives at their characteristic occupations, chief among the popular attractions of which were the Javanese theater and the Annamite Buddhist temple. The members of the Congress, guided by the local committee, spent many hours in these savage inclosures and houses, studying the people and their arts, and listening to their rude music.

Under such favorable auspices met the Ninth Congress of Anthropology and Prehistoric Archæology. It will be long before such wonderful advantages are again brought together for studying the natural history of man.

The previous congresses have been as follows:

1. Neufchâtel, 1866.
2. Paris, 1867.
3. Norwich, 1868.
4. Copenhagen, 1869.
5. Bologna, 1871.
6. Brussels, 1872.
7. Stockholm, 1874.
8. Buda Pesth, 1876.
9. Lisbon, 1880.

From Paris my journey was to Cologne, where I visited the museum. I was greatly impressed in all German and French cities and towns with the care taken of the local museums. This spirit should be fostered in every way in our own country.

At Leipzig I experienced the greatest disappointment in not being able to inspect the Museum für Völkerkunde, which contains the celebrated Klemm collection. More than 20 years ago the writer became acquainted with Dr. Klemm's methods and motives, and presented a résumé of his work in the Smithsonian Annual Report for 1869. Shortly, the Leipzig collection will be installed in the new building. The disappointment of not seeing the Klemm collection was quite compensated for in the profitable study of the Königliches Zoologisches and Anthropologisch-Ethnographisches Museum in Dresden. This is not the largest, but it is one of the best administered museums in the world. The steel case has been adopted, the arrangement of material is topical, and the labelling is excellent. Worthy of the highest praise is the series of little maps which accompany the specimens. The continental areas are denoted by colors, and the location of each species is indicated by a colored spot or line on the map. The monographs published by the Museum, under the title "Publicationen aus dem Königlichen ethnographischen Museum zu Dresden," are of the greatest value. Dr. Meyer greatly prefers the photolithograph to the old-fashioned colored plates, because the latter are not truthful. The size of these monographs is too large, however, because it is inconvenient to file them with other works of the same class. In Dresden the curator saw the "human beast of burden" illustrated to perfection by woman. She occurs in two rôles, as the pack-animal and as the draft-animal. In the former she wears a hamper holding about a bushel, which is flat on the side next to her back. Two shoulder-straps pass from the upper margin down in front of her shoulders and backward under two of the frame-sticks of the basket, projecting an inch or two below the bottom. The basket is carried like a knapsack. In the latter rôle she is hitched to a little wagon in company with dogs. I counted five hundred of these composite teams in a single morning in Dresden. The woman seems to have the harder share of the work, for she has to pull, to hold back, to steer the wagon, to dispose of the merchandise, and to attend to household cares, while the dog sleeps.

In Dresden I had a profitable interview with Mrs. Zelia Nuttall, a lady deeply learned in ancient Mexico. Her present work is an extension of the "Throwing-Sticks" into the Mexican arena, where she has been able to trace the apparatus in many various forms.

From Dresden my journey was to Berlin, where, although missing the great lights of anthropology, I had the pleasure of studying the collections. I need not speak of the Old Museum, and the National Gallery, of the University, the Zoölogical Garden, and the great library. They excite my admiration, but they were not especially anthropological. I was extremely delighted with the evolutionary series of fire-arms and artillery in the Zeug-haus. This is one of the best worked out historico-technic series I have seen. Two museums in Berlin are most attractive to the anthropologist and to the historian, the Kunstgewerbe Museum and the K. Museum für Völkerkunde. In the former, the substances, arts, evolution, and history predominate. It is the German South Kensington. In the latter, topographical, ethnical concepts predominate. Those two great museums are installed in beautiful new buildings erected for the purpose, far away from the site of the National Gallery. The Anthropological Museum is built on the corner of Zimmer-strasse and Königgratzer-strasse, in form of an irregular quadrangle, with an entrance tower at the intersection of the streets. The building is four stories in height besides the basement. In the first exhibition story is installed with great effect the Schliemann collections and the archæological treasures. On the second story are to be seen the spoils of Africa, Oceanica, and America. In the third story are the treasures of Eastern Asia and in the fourth story the anthropological material. Too much can not be said in praise of the richness of this museum. The arrangement being simply by regions, by nationalities, or by tribes, little attempt has been made to work out any of the finer problems of ethnology.

From Berlin the curator journeyed to Stockholm, where with unspeakable pleasure he had the opportunity of examining the work of Hildebrand and Montelius in the National Museum. The lower story of this vast building is given up to the history of Sweden during 4,000 years. A very small case near the entrance contains specimens representing palæolithic Sweden. The neolithic period widens out into an immense exposition of the most beautiful and finely wrought objects of flint. The bronze age is carefully studied out and illustrated by material that has excited the admiration of the world. There is an enormous quantity of gold objects mixed with the bronze. In order to secure all the precious metal found by men in excavating, the Government takes the object at its bullion value, with an honorarium. This saves all precious objects from the melting-pot. Next comes the Iron age, then the Middle age, then modern Swedish history, closing with the coins, medals, decorations, and monuments of the reigning family. There does not seem to be a break in the 4,000 years. The ethnographic collections are not separately installed, having formed a part of the natural history museum.

My next journey was to Copenhagen: the city of Thorwaldsen, Nyerup, Thomsen, Worsaae; and later of Sophus Muller, Herbst, Holm and Bahnson. Especially interesting are two ancient log coffins, showing the mortuary customs of the ancient Danes. As soon as you enter the old Nordisk Museum you are at once brought into relation with the shell-heaps or Kjökkenmöddings. In some of the vitrines the long, graceful flint flakes are piled ten deep. The stone age of Denmark, as of Sweden, assumes the neolithic type. There is as yet no palæolithic age. As soon as you pass within, you are in the presence of leaf-shaped blades, daggers, celts—the largest in the world: some measuring over 16 inches in length—crescent-shaped blades, sharpening stones, arrow-heads (as delicate as those of California Indian specimens), and innumerable forms in bone and antlers. For its size Copenhagen is the best equipped city in the world for the ethnologist. Commencing with archæology, the stone age repeats the story of Stockholm, with enough variety to make one glad to visit both. From the earliest appearance of man in Danish territory you are able to trace him down to the historic period. The objects are classified by material, form, and period. The bronze age rooms are even more instructive and thought-inspiring. Gold and amber are here in luxurious abundance. Even in those early times seafaring Danes must have learned to scour the earth. Certainly there is neither copper nor tin nor amber around these islands and peninsulas. The molds in which celts, razors, reaping-hooks, daggers and other tools were cast are made of steatite. These molds and other apparatus have raised the critical question whether the Scandinavian bronze age originated on its own soil.

Here, the iron age antedates the Christian era, but so easily does iron yield itself to decay that we shall have to call it the golden age, so far as good specimens are concerned. The iron age continues here to the age of gunpowder, or to speak more by the Museum card, in Denmark to the *coup d'état* of 1606. The armor is shown in the Royal Artillery Museum, but you can follow the stream of Danish history through church relics and furniture. To complete the whole story of Denmark, you have only to spend a day in the old Rosenberg palace to follow the present dynasty to the reigning sovereign. Of the Ethnographic Museum, celebrated during the whole century, it is only necessary to say that it was the first attempt in the world to arrange museum material by peoples. This collection is uniquely rich in East Greenland specimens, the spoils of Captain Holm. Fifty rooms cover as many natural or ethnic subjects, and hundreds of specimens are here that can not be duplicated, because of the early day at which the collection began to be formed. The objects of interest to the ethnologist in Hamburg are to be seen in two buildings, the Kunsthalle and the Gewerbe-schule Museum. The former is the art collection of the city and is really an imposing building in the midst of a great forest park. The Gewerbe-schule is on the order of South Kensington and is worth visiting. The gaps in European art become truly painful when the hiatus of a millenium is pointed out by the majolica pottery following immediately the later Roman. The ethnographic collection is as poor in its installation as it is rich in material. The museums of Brussels are superb in material and treatment and are worthy of the distinguished men whose monuments they are. The one series which makes them preeminent is in the National Gallery. It was gathered from the bone-caves, which have yielded such wonderful paleontological results. The specimens are mounted with the greatest of care, and in the arrangement of one series of cases above another the economy of space is remarkable. In the Place de Hal are to be seen excellent collections of armor, antiquities of Belgium, and, in the upper story, the Ravenstein collection of gems and antiquities. In Amsterdam, Leyden, and the Hague are world-famed collections. In the first-named city the museum building is quite imposing and the representations of Dutch life are worth studying. The curator was extremely unfortunate in missing Dr. Schmeltz and other ethnologists. The historical and ethnological collections here rank with those of London, Paris, Berlin, and Copenhagen. In Antwerp is the Plantinian collection, perhaps the most complete technical unit exhibit in the world. In the National Museum at Washington a perfect specimen includes three requisites: a genuine object, pictures of the object in process of manufacture and in use, and finally, full description of its origin, structure, and function. These lay the foundation for the cabinet, the portfolio, and the archives. The Plantinian museum shows the history of the art of printing, in machinery and appliances, in pictures and in histories of printing and apparatus.

Time would not allow the curator to extend his visit further than to the museums mentioned. The prevailing impression left upon his mind is that, varying as they do in their stock of material and genius of their directors, there is no one classific concep t in which all should be arranged The best results are reached in those collections where the material is servant to a master mind.

## PRINCIPAL ACCESSIONS.

The accessions to the ethnological collections of the National Museum during the year to which special attention should be called are the following:

Mr. Romyn Hitchcock, returning from Japan, after a two-years' sojourn, has enriched the ethnographic series with many most desirable specimens, gathered on the spot with the view of illustrating the life of the people. Costumes were secured which truly represent Japanese common life. The full contents of a kitchen, the apparatus of characteristic crafts, weights and measures, furniture, and a large series connected with Japanese religion, help to illustrate the true Japanese life. Mr. Hitchcock spent much time among the Ainos, utilizing his talent as an artist to add value to his material secured by means of many pictures. This Aino material, fully labeled, is installed together in the Museum. A life-sized figure of a man in costume, models of the house, granary, bear-cage, and sacred hedge in miniature, specimens of Aino handicraft, and a series of photographs enable the visitor to gain a slight conception of the Aino manners and customs.

The Museum African material has been enriched by accessions from the Inhambane Zulus, collected by the missionary, Rev. E. H. Richards, and presented by the Oberlin College.

The United States Eclipse Expedition was able, through its naturalist, Mr. W. H. Brown, to secure for the Museum its first material from Angola. To this must be added the generous gift of Mr. J. H. Camp from the Congo. Fortunately, while these three collections were being registered, the services and unique collection of Mr. Heli Chatelain, for a long time missionary on the west coast of Africa, were secured.

Growing out of the public interest in Samoan affairs the Museum acquired collections made by Admiral Kimberly, U. S. Navy, and Ensign W. E. Safford. The former was sent by Mataafa and Malietoa, chiefs of Samoa, to the U. S. Navy Department.

Following up the plan pursued by Lieutenant Bolles with the Eskimo collection and by Ensign Niblack with the northwest collection, the former, aided by Mr. William Churchill, has brought together into a single court the specimens from the region commonly called Oceanica, including several well-marked types of the Papuan, the Negrito, the Malay, the Polynesian and the Australian.

The recent collections brought to the Museum by expeditions to Samoa, added to the treasures secured fifty years ago by Captain Wilkes, enable the curator to make a fair showing of this part of the world. Lay figures representing the Papuan, the Dyak, and the Samoan, in native dress, have very much added to the attractiveness of the hall.

From the Sandwich Islands the Museum acquired photographs and specimens, the gift of Mrs. Sybil Carter, wife of the Hawaiian minister. These are of great value, because of the familiarity of Mrs. Carter with the aboriginal customs of the islands.

Dr. H. N. Allen, court physician to the King of Corea, deposited in the Museum his rich collection from that kingdom. Many of these objects were presented by the King and show the best art-skill of the country. This royal gift and Ensign Bernadou's collection give an excellent picture of Corean life.

The Hupa Valley, California, is represented by two collections, one made by Mr. N. J. Purcell, and the other by Mr. Jeremiah Curtin. They admirably supplement the great collection made by Capt. P. H. Ray, U. S. Army.

Dr. George M. Kober, U. S. Army, gave a number of specimens from Idaho and Washington, regions not so fully illustrated in the Museum as the States farther south.

The collection of Navajo silver work, on which Dr. Washington Matthews, U. S. Army, based his paper in the Third Annual Report of the Bureau of Ethnology, has been acquired and will be set up to illustrate his monographs.

Through the Interior Department a large series from Washington, collected by Rev. E. C. Chirouse, was received. The specimens are old and genuine Indian work of the greatest value.

Mr. W. W. Rockhill deposited in the Museum the ethnological results of his second Thibetan exploration. The collection consists of many unique specimens illustrating the customs of the Chinese, Mongols Si Fan, and Thibetans. Mr. Rockhill also deposited a collection of foreign weapons and Chinese art-enamel work in the Museum, and has rendered gratuitously invaluable aid in labeling and cataloguing these materials.

In the technic series a separate court has been set aside for the exhibition of mortuary customs to illustrate the study in this subject made by Dr. H. C. Yarrow.

The crowded condition of the halls rendering it impossible to exhibit many new series, the curator in the spring of 1890 commenced to make a systematic card catalogue of the entire ethnologic exhibit.

### ADDITIONS TO THE DEPARTMENT OF ETHNOLOGY, ARRANGED BY LOCALITIES.

*Greenland.*—Mrs. J. G. Bruff (accession 22308), seal-gut caps (2).

*Labrador.*—Miss Anna L. Ward (accession 23204), child's shoes (1 pair); tobacco-bags (2); model of summer tent (1); seal-skin coat (1).

*Cumberland Inlet.*—Mrs. J. G. Bruff (accession 22308), whalebone and sinew.

*Jones Sound.*—Mrs. J. G. Bruff (accession 22308), seal-lance (1); bird-lance with throwing-stick.

*Canada.*—Mrs. J. G. Bruff (accession 22308), birch-bark canoe (1). Rev. Father Walter (accession 22209), birch-bark boxes (2); beaded stole (1); flower-holder (1).

*Yarmouth, Nova Scotia.*—R. T. Van Norden (accession 22629), photograph of inscribed rock.

*Alaska.*—Capt. M. A. Healy (accession 23141), photographs of Alaskan natives (89). Lieut. George T. Emmons, U. S. Navy (accessions 22912, 22459), photographs of Haida Indians performing witchcraft (1); wallet in process (1); decoy for young deer (1). Dr. T. H. Bean (accession 22762), Kadiak stone lamp (1). Dr. George M. Kober (accession 22761), spoon of musk-ox horn (1).

*Fort St. James, British Columbia.*—Capt. C. E. Bendire, U. S. Army (accession 22503), marmot skin blanket (1); bear's feet moccasins (1 pair); trade skins of beaver and ermine (6).

*Skidigate, British Columbia.*—Dr. T. H. Bean (accession 22762), cedar bark-beater (1).

*Tulalip Reserve, Washington.*—E. C. Chirouse (accession 22496), skull of a Dowamish Indian (1); hat (1); rush mat (1); basket-kettle (1); games (2); wooden dish (1); float (1); spoons (3); tobacco-bag (1); paint (1); cymbals of pecten shell (1); cedar bark tow (1); paddle and bailer (2); adzes (1); earring (1); wedge (1); tweezers (1); chisels (3); comb (1); harpoon handle (1); fancy work done by pupils (4); roe (food) (1); netting-needle (1); mortar and basket (1); fish-hooks (2); bark-peeler (1); wedge for bark (1); card for bark (1); hammer (1); cedar root mat (1); basket (1); child's skull (1); pictures of Indians (7); carrying strap (1); mat-needle (1); mat-creaser (1); hunter's cap (1).

*Spokane Indians, Idaho.*—Dr. George M. Kober (accession 22761), bead necklaces (2); basket jar (1); box (1); bead wristlet (1); stone pipe.

*Nez Percé Indians, Idaho.*—Dr. George M. Kober (accession 22761), moccasins (1 pair); beaded coat (1); head-dress (1); trousers (1 pair).

*Cœur d'Alène Indians, Idaho.*—Dr. George M. Kober (accession 22761), stone pipe (1).

*Colville Indians, Idaho.*—Dr. George M. Kober (accession 22761); embroidered gloves (1 pair).

*Năl-tún-né-tûn-né Indians, Oregon.*—Dr. J. Owen Dorsey (accession 22892), fish-hooks (2); retrieving-harpoon (model) (1).

*Concow Indians, California.*—N. J. Purcell (accession 23553), milkweed flax and cord (2); dance-whistles (2); baskets (2); cradle (1); dance-belt (1); carrying-sacks (2).

*Digger Indians, California.*—N. J. Purcell (accession 23553), feathered basket (1).

*Wylakie Indians, California.*—N. J. Purcell (accession 23553), bead necklaces (2).

*Ukie Indians, California.*—N. J. Purcell (accession 23553), sun-basket (1); dance-whistle (1); sieve (1).

*Pitt River Indians, California.*—N. J. Purcell (accession 23553), bow and arrows (17); tanned buckskin (1).

*Round Valley, California.*—N. J. Purcell (accession 23553), watch-guard (1); reins (2); comb (1); part of harness (1); basket material (4); stirring-bone (1); bridle (1); hitching-rope (1); feather head-dress (1); reata (1); whips (2).

*Modoc Indians, California.*—N. J. Purcell (accession 23553); cornmeal basket (1).

*Little Lake Indians, California.*—N. J. Purcell (accession 23553), dance head-dress (1); feathered and beaded basket (1); dance-whistle (1); child's basket (1); acorn soup-basket (1).

*California.*—N. J. Purcell (accession 23553), shell wampum (1).

*Klamath Indians, California.*—Dr. George M. Kober (accession 22761), stone pipe (1).

*Hupa Indians, California.*—Jeremiah Curtin (accession 22591), baskets (20); dance-robe (1); stone wedge (1); meat-bowl (1); acorn flour-scoops (2); sifter (1;) woman's spoon (1); pipes (3); purse and shell-money (1); eel and salmon dam (model) (1); bow and arrows (6); louse-crusher (1); salmon trays (3); cradle (1); scrubbing-brush (1); eel net (1) net-shuttle (1); man's spoon (1); wooden bowl (1); stone mortar (1).

*San Fernando, California.*—Miss Belle Roy Negus (accession 22979), reeds used in roofing.

*Mission Indians, California.*—Stephen Janus (accession 22610), hammock (1).

*Nokum Indians, California.*—L. L. Frost (accession 22672), fire-drill (1); fish-hook (1).

*Chippewa Indians, Wisconsin.*—Gen. T. J. Morgan (accession 23171), wooden hoe (1). Mrs. J. G. Bruff (accession 22308), beaded cape (1); pipe (1).

*Bannock Indians, Idaho.*—Dr. George M. Kober (accession 22761), leggings (1 pair).

*Shoshone Indians, Idaho.*—Dr. G. Brown Goode, arrow (1).

*Omaha Indians, Nebraska.*—Dr. G. Brown Goode, arrow (1).

*Sioux Indians, Nebraska.*—Mrs. A. C. Jackson (accession 22913), quill-work (5); moccasins (3 pairs); plumes (3); war-clubs (2); pipe and stems (4); pipe-bags (4); spoons (8); bow and arrows (31); necklaces (4); mats (5); game (1); beaded wallet (1); dolls (2); medium-charms (3); arm-rings (2). Mrs. J. G. Bruff (accession 22308), bow, bow-case, and quiver; arrows (10); head ornaments (2); moccasins (1 pair); knife and case (1).

*Winnebago Indians, Wisconsin.*—Dr. Albert S. Gatshet (accession 22675), charms (2).

*Pawnee Indians, Indian Territory.*—Mrs. J. G. Bruff (accession 22308), arrows (4).

*Cheyenne Indians, Indian Territory.*—Mrs. J. G. Bruff (accession 22308), moccasins (1 pair).

*Cherokee Indians, North Carolina.*—Bureau of Ethnology (accession 22419), mortar and pestle (1).

*Navajo Indians, Arizona.*—Dr. Washington Matthews, U. S. Army. (accession 23123). necklaces (3); bracelets (4 pairs); earrings (2 pairs); finger-rings (2); buttons (15); crucifix (1); hair-combs (2); belt-buckle (1); wrist-guard (1); gorget (1); basket (1); miniature canteen (1).

*Zuñi Indians, New Mexico.*—Mrs. T. E. Stevenson (accession 23123), fetiches (9). F. W. Hodges (accession 23236), "kicking-block" (game) (1).

*Comanche Indians, New Mexico.*—Mrs. J. G. Bruff (accession 22308), moccasins (1 pair).

*Langley's Peak, New Mexico.*—Maj. J. W. Powell (accession 23046), offerings from rain-shrine (13).

*Palada Peak, New Mexico.*—Maj. J. W. Powell (accession 23046), offerings from rain-shrine (12).

*Pueblo of Zia, New Mexico.*—Maj. J. W. Powell (accession 23046), offerings to war gods (9).

*Pueblo of Jamez, New Mexico.*—Maj. J. W. Powell (accession 23046), shrine offerings (4).

*Apache Indians, New Mexico.*—Mrs. J. G. Bruff (accession 22308), arrows (6). Dr. Geo. M. Kober (accession 22761), pouch (1); pottery (2).

*New Mexico.*—Rev. Father Walter (accession 22210), old Spanish cross (1).

*Boston, Massachusetts.*—Denison Manufacturing Company, game-counters, (1 lot).

*Maryland.* J. Le Duc (accession 23260), binding-peg (1).

*District of Columbia.*—Peter Burger (accession 22567), cooper's tools (3); bullet-molds (1 pair); match-box (1).

*United States.*—Dr. John S. Billings, U. S. Army (accession 21388), gaffs for cock-fighting (2 pairs).

*Virginia.*—Dr. J. B. Hodgkin (accession 23185), slung-shot (1). Mrs. J. G. Bruff (accession 22308), horn-dipper (1). Julian Hargrove (accession 22890), flint-lock musket (1).

*Honduras.*—Mr. E. W. Perry (accession 22254), photographs of stone image (2); small image of armadillo (1).

*Nicaragua.*—Government of Nicaragua (accession 23200), carved bowls and cups (7); hammock (1).

*Paraguay River, South America.*—Mrs. J. G. Bruff (accession 22308), necklace of panther claws (1).

*Peru.*—Peabody Museum (accession 23111), coiled basket (1).

*Fuegians, Straits of Magellan.*—Prof. Leslie A., and Thomas Lee (accession 22760); harpoons and points (41); knife (1); fishing-lines and hooks (3); awls (2); club (1); paddle (1); baskets (2); necklaces (7); skin-cloak (1); sling (1); bows, quiver and arrows (17); otter skin in stretching frame (1).

*England.*—Mrs. J. G. Bruff (accession 22308), shoe-buckles (2). Edward Lovett (accession 22452), calender for smoothing linen (1); building-flint (1); snuffers (3 pairs); drinking-horns (2); candle-holder (1); carrying-yoke (1); human harness (1); porter's knot (1); deer-horn pick (1); photographs illustrating flint knapping industry (3); rush clips (4); watch-case (horn); watchman's staff (1); toaster (1); tinder-boxes (2).

*Ireland.*—Edward Lovett (accession 22452), fir-candles (1 lot).

*Scotland.*—Edward Lovett (accession 22452), rush clip "Peer man" (1).

*Norway.* —Mrs. Zelia Nutall (accession 22568), carved parts of Norwegian cart harness (2).

*Turkey.*—Edward Lovett (accession 22452), pottery figure (1). Mrs. J. G. Bruff (accession 22308), Pasha's standard (1).

*Egypt.*—M. F. Savage (accession 22428), pottery lamp (1).

*Morocco.*—Royal Ethnographic Museum, Berlin (accession 23146), carrying-baskets (2).

*Tripoli.*—Mrs. J. G. Bruff (accession 22308), yatagans (2).

*South Africa.*—Edward Lovett (accession 22452), bored stone for digging stick (1).

*Inhambane Zulus, South Africa.*—Rev. E. H. Richards (accession 22262), assagais (6); arrows (10); bows (4); club (1); dirks (2); grass-cloth (2); mats (2); bracelets (5); necklaces (3); bark-blankets (28); horn (1); crude rubber (3); snuff-boxes (1 pair); rattle (1); whip (1); xylophone (1); knives and forks (9); comb (1); ax (1); spoons (5); basket (1); ceremonial stick (1); sticks for beating circumcised boys (12).

*West Africa.*—Mrs. J. G. Bruff (accession 22308), shield (1); palaver stick (1).

*Angola, West Africa.*—United States Eclipse Expedition, through William H. Brown (accession 23272), fishing-basket (1); fetish idol (1); pipe (1); hoe (1); carrying-barrow (1); carrying-baskets (3); gaming-stool (1); pottery dishes (3); drum (1); arm-pad (1); fetish paint (1 bottle); weaving outfit (1); *marimba* (1); *hungu* (musical instrument) (1).

*Wasegua Negroes, Africa.*—Royal Ethnographic Museum, Berlin (accession 23146); tobacco pipe (1); tobacco-pouch (1); assagais (2); woman's dress (1); basket (1).

*Congo River, West Africa.*—J. H. Camp (accession 22376), war knives (6); spear-heads (4); game-sack (1); loin-cloth (1); cap (1); witch-bell (1); native rope (1);

leather girdle (1); war-horn (1); head-rest (1); arrows (3); musical instrument (*sansa*) (1); currency, copper and brass wire, beads, copper cross, brass-tacks and handkerchief (6); cloth (1 piece); dress (1); iron necklace (1); spoon (1); head of fish-spear (1); porcupine quills (1 lot); hippopotamus spikes (2); hippopotamus tusks (2).

*Arabia.*—Edward Lovett (accession 22452), carnelian arrow-tip necklace (1). Mrs. J. G. Bruff (accession 22308), Arab gun (barrel made in Venice) (1).

*Afghanistan.*—Barnett Phillips (accession 22384), sandals (1 pair).

*Hindoostan.*—Edward Lovett (accession 22422), agate chips (1 lot); Malabar tinder box (1).

*India.*—Edward Lovett (accession 22462), decorated tiles (2); jar (1); painting on mica (1); "chillum" pipes (1); wooden pipe (1); leg-bangles (1 pair). Henry Balfour (accession 23212), model of a Hindoo sacred fire-drill (1).

*Corea.*—Dr. H. N. Allen (accession 22405), embroidered beds and pillows (4); fans (ladies') (6); men's fans (5); pillow end (1); round pillow (1); ink-stones (2); King's medal (1); rolls of fine paper (4); uncut seals (9); pencil-jar (1); tobacco-boxes (2); carved seals (2); pipes (3); box for seals and ink (1); pencils (2); books (3); belt-clasp (1); knife and chopsticks (1); paper-holder (carved) (1); scent-bags (2); string of cash (1); samples of cloth (5); bow (1); quiver and arrows (9); lady's hat (1); hair-pin (1); embroidered screen (1); lantern-covers (2); carving in soapstone (1); scent-bottle (1); beads for hat (1); comb (1); child's knife (1); jade fan pendant (1); brass dinner-service (37 pieces); marble pagoda (model) (1); bamboo blinds (25; zither *yang gum* (1); bowl (common ware) (1); saucer (fine green pottery) (1); rice-pot (stone) (1); bowl (1). W. W. Rockhill (accession 22822), Corean paintings (costumes) (18).

*China.*—W. Woodville Rockhill (accessions 22455, 22699), paintings of Buddhist saints (2); brick tea (7 samples); money-scales (1); oiled cotton (1); felt-hat (1); socks (1 pair); sandals (3 pairs); portrait of Hoshang, or high priest (1); spectacles in case (1 pair); stamp for visiting-cards (1); pipe and tobacco-pouch (1); vermicelli *Kua-mien* (1 sample); bow, bow-case, arrow-case and belt (1); cotton goods (1 sample); cotton trousers (1 pair); silk-belt (1); leaves for prayer-wheel (1 lot). Stewart Culin (accession 23292); funeral money used by Chinese in the United States (5 kinds). Mrs. J. G. Bruff (accession 22308), images of terra cotta (3); images of agalmatolite (2), bow and arrows (9); shield (1); hat (1); queue (1); image of household god. Dr. H. N. Allen (accession 22405), cash swords. Romyn Hitchcock (accession 21476), pottery bowl (1). Mrs. J. King Van Rensselaer (accession 23006), dominoes (1 set).

*Mongolia.*—W. Woodville Rockhill (accessions 22699, 22700, 22455, 22822), teakettle (1); barley meal *tsamba* (1 lot); thimble (1); winter hat (1); rope (1); powder-chargers on belt (1); boots and garters (2 pairs); charm-box (1); fire-box (1); powder-horn (1); woolen garters (2 pairs); mold for images of tsamba meal (1); eating-bowl (1); strike-a-light (1); knife and chop-sticks (1).

*Koko-nor Province, China.*—W. Woodville Rockhill (accession 22699, 22455, 22709), knife of the Si fan (1); hat worn by Si fan (1); shell ornaments for woman's head dresses (1 lot); gown (1); bellows (1); felt (1 piece); riding-whip (1); matchlock gun and equipments (1); bullet bag and ammunition-pouch (2); powder-horn (1); boots (1 pair); trousers (1 pair).

*Thibet.*—W. Woodville Rockhill (accessions, 22700, 22455, 22976, 22699, 22822), Lama priest's hat (1); garters for boots (3 pairs); woman's belts (4); prayer-beads (1 string;) edible root *choma* (1 lot); charm of tsamba meal (1); tobacco-pouch (1); scarfs of felicitation (1 lot); bell used in Lamaist ceremonies (1); silver spoon (1); eating-bowl (1); ground barley in bag (1); shirt-buckles (3); strike-a-lights (2); native woolen cloth (1 lot); money-bags (2); sealing-wax (2); bamboo pens (2); women's boots (1 pair); teapot (1); strainer for tea (1); tea-churn (1); swords (2); saddle (1); butter-box (1); saddle-bags (2); eye-screen (1); needle-case

(1); pouch for tea-bowl (1); photograph of Thibetan jewelry (1); felt rain-coat (1); woolen gown (1); shirt (1); turban (1); finger-ring (1); earrings (2); shirt-button (1); pipe (1); copper kettle (1); scroll-picture of Lama convent (1); brass sceptre of Indra (1); barley-meal bag (1); robe (1); joss-sticks (1 lot); seal (1).

*Japan.*—Romyn Hitchcock (accession 21640, 16311, 21963, 21675), tobacco-boxes (2); teapots (20); coolie's hats (2); trays (5); cake-bowl (1); lunch-boxes (3); wooden ladles (10); candlestick (1); tea-sets (8); rice-box (1); ash-bowl (1); tobacco pipes (5); writing outfits (3); table (1); rice cups (4); bowls (10); tinder-boxes (2); tea-tray (1); vases (5); cup and saucer (1); straw sandals (2 pairs); carpenter's line (1); fire-boxes (5); hair ornaments (1 lot); flags (2); dried fish (10); seaweed starch (1); bamboo flutes (2) writing utensils (15); smoker's outfit (2); counting-boards (abacus) (2); rule (1); lining for hibachi (1 lot); work-box (1); Hindoo dish (1); stoves (2); writing material (8 samples); ink-holder (1); scrub-brush (1); tea-cups (6); letter-file (1); towel-rack (1); incense (1 lot); slippers (1 pair); saki bottles (3); tea-stirrers (3); chopsticks (3 packs); chopstick holder (1); bamboo boxes (3); gardener's tools (4); chain weapon (1); sets for tea ceremony (2); splint-matches (4 bundles); musical instrument (1); sacred paper-flags (1 lot); temple-beads (3); healing-water bottles (6); prayer-book (1); paint-brushes (9); basket (1); saki drinking sets (4 pairs); painted bowl and saki bottle (2); mortuary jars (5); tea-caddies (2); saki warmers (3); tea-jug (1); vessels for cooking meats (6); burial-pottery, fragments, etc. (1 lot); shrine of Kolohira (1); shrine, image of Bishamon (1); bed *futons* (1 set); rincing-bowl (1); saki stands and cups (21); iron saki pots (2); refreshment table (1); soup-plates (10); fish-bowl (1); chest of drawers (2); dress of a laboring man (4 pieces); winter clothing of a merchant (7 pieces); clothing of a Jinrikisha man (2 pieces); soup-bowl and spoon (2); confection-bowl (1); toilet-case (1); tin in basket holder (1); night-light (1); paper fish (1); doll (1); cloth (6 samples); rain-coats (2); household shrine (1); bronze hibachi (1); utensils used in blacking the teeth (1 set); hand-basket (1); suit for child (1); cotton rolls (2); samples of tea (6); tobacco-pouches (2); wooden awls (3); straw-hoops (2); fan (1); beads for praying (4 strings); healing water bottles (4); incense (5 kinds); toy bag of rice (2); tables (7); lacquer cups (6); lacquer soup-bowls (4); porcelain plates (6); water-kettle (1); Mrs. J. King Van Rensselaer (accession 23174), playing-cards (1 pack). Hiramatz Rei and V. Marshall Law (accession 23113), section of human hair rope used in building temple (1); photograph of hair ropes (1); table of measurements of ropes (1); plan of temple (1). Japanese department of education, Tokio (accession 16311), dress fans (3); fans (25); scissors (3 pairs); vegetable knives (4); cooking-pan (1); saws (2); hammers (4); awls (2); chisels (2); planes (3); pincers (1 pair); tweezers (1 pair); whetstones (2); gimlets (6); razor (1); smoothing iron (1); sickle (1); paper-cutter (1); tongs (1 pair); cleaver (1); radish-grater (1); tongs (5 pairs).

*Ainos, Yezo, Japan.*—Romyn Hitchcock (accessions 22393, 22633, 21640), mats (5); bows (4); quivers with arrows (3); shoes (1 pair); leggings (6 pairs); snow-shoes (1 pair); sandals (1 pair); baskets (4); bark cord (9); bark cloth (1 roll); coats of bark (3); belts (4); looms (2); fish-spear (1); dippers (2); basket of bark (1); ladle (1); salmon-spear (1); carrying-case (1); dried fish (1 lot); carrying-bands (3); pipes (7); carrying-bag (1); dish (1); bowl (1); head-dress (1); hoe (1); gloves (1 pair); aprons (2); god-sticks (3); broiling-sticks (2); tobacco-boxes and sticks (3); mustache sticks (9); large knife in case (1); lacquer cup-(1); shell plate (1); tea-cup rests (2); thread-winders (4); wooden carved plates (4); bark dishes (4); net-needle (1); earrings (2 pairs); jew's harp (1); necklaces (2); chopsticks (1 lot); tattooing-knives (2); knife in carved case (1); silver ornament (1); spoons (16); fish-skin (2 pieces); belt-loom (1); wooden hammers (2); knife-cases (1); belt reed (1); foods (13 samples); towel-rack (1);

carrying-bands with stick (1); arrows and stone arrow-heads (1 lot); materials for mats (2 lots); arrow-poison (2 lots); rake (1); rat-trap (1); traps (2); pot-hook (1); baby-carrier (1); aconite plant used to make arrow poison (1); bowls (2); wooden tray (1); sword (1); male costume (1); female costume (1); photographs of Ainos, house life, etc. (26); wooden spatula (1); women's spoons (2).

*Samoan Islands.*—U. S. Navy Department (accession 23197), fine mats (4); rugs (6); Kava bowl (1); tapa blankets (108); fans (42); baskets (22); Kava cup (1); cinctures (2); necklaces (2); comb (1); clubs (2); spears (2); sashes of tapa cloth (13); spread (1). Ensign W. E. Safford, U. S. Navy (accession 22259), fly-flapper (1); pillow (1); sennit (2 samples); tapa blankets (5); sashes (2); basket wallet (1); children's dresses (2); fine mat (1); meats (3); floor-mat (1); varieties of tapa (4); fan (1); adze blade (1); combs (2); head-dress (1); fishing tackle (1); clubs (3); fish-hook (1). Harold M. Sewell (accession 22187), fire-sticks (1 pair).

*Sandwich Islands.*—Mrs. Sibyl Carter (accession 23273), braid of squash fiber (1); photographs of natives (11); fans (3); anklet of shells (1): cocoanut shell dish (1); necklace of *Kukui* nuts (1); wallet (1); tapa mallet (1); feather wand *hanga-hanga* (1); hats (2); carrying-pole (1). Mrs. J. G. Bruff (accession 22308), fish hooks (2); ornamented skin (1); fetish necklace of whale tooth and human hair (1). Miss Una Clarke, hat band of shells (1). W. F. Hillebrand (accession 22638), plaited rope (1); tapa cloth (1).

*Fiji Islands.*—Mrs. J. G. Bruff (accession 22308), sharks' teeth spear (1), stone image (1).

*New Caledonia.*—Royal Ethnographic Museum, Berlin (accession 28146), woman's dress (1).

*Mangaia Group.*—R. L. Garner (accession 22295), adze (1).

*Malay Archipelago.*—Mrs. J. G. Bruff (accession 22308), cocoanut cup with tortoise shell cover (1).

*Sarawak, N. Borneo.*—F. T. Redwood (accession 22973), blow-gun (1).

*Palao Islands.*—Royal Ethnographic Museum, Berlin (accession 23146), comb (1); tortoise shell dish (1); woman's dress (1).

*Solomon Islands.*—Edward Lovett (accession 22452), polished celt (basalt) (1).

*Kingsmill Islands.*—Mrs. J. G. Bruff (accession 22308), shark teeth spear (1).

*South Sea Islands.*—Mrs. J. G. Bruff (accession 22308), tattooing instruments (2).

*Sooloo Islands.*—Mrs. J. G. Bruff (accession 22308), cruse (1).

# REPORT ON THE DEPARTMENT OF AMERICAN PREHISTORIC POTTERY IN THE U. S. NATIONAL MUSEUM, 1890.

By WILLIAM H. HOLMES, *Honorary Curator.*

During the fiscal year ending June 30, 1890, little work has been done in the Department of Aboriginal Pottery. The installation of the exhibition series is practically completed and all that remains to be done is in the direction of more thorough labeling of individual specimens.

Accessions have not been as numerous as in preceding years, yet much of value has been acquired.

The more important accessions of the year include a series of fragmentary ware from Bear Point, Perdido Bay, Alabama, contributed by Mrs. A. T. Mosman and A. B. Simons, and supplementary to the collections of F. H. Parsons acquired last year; and a remarkable group of vases obtained from a mound on the Savannah River, Richmond County, Georgia, by H. L. Reynolds. These, and some other contributions mentioned in the accompanying list, were acquired through the agency of the Bureau of Ethnology.

The routine work of the department has consisted chiefly in labeling and entering upon the books such new material as has been acquired. A number of sets of specimens have been selected for exchange.

Such researches as have been conducted by the curator, relate mainly to collections from the mounds of the Mississippi Valley and adjacent regions. The work undertaken is to form a part of the monographic work of Dr. Cyrus Thomas upon the Mound Builders.

The last catalogue number in June 1889, is 135131; in June 1890, 135363.

The curator has published three papers during the year. These are noticed in the Bibliography.

## ACCESSIONS FOR THE YEAR ENDING JUNE 30, 1890.

*Oshkosh, Wisconsin.*—Joseph F. James (No. 135133), pottery fragments.

*Clark County, Illinois.*—H. G. Hodge (No. 135142), pottery fragments from mound near York.

*Upshur County, West Virginia.*—L. V. McWhorter (No. 135143), pottery fragments.

*Potomac Creek, Virginia.*—W. H. Phillips (No. 135144), pottery fragments.

*Two Lick Creek, Harrison County, West Virginia.*—W. H. Holmes (No. 135152), pottery fragments.

*San Juan, Toetihuacan, Mexico* —F. W. Hodge (Nos. 135159, 135168), pottery fragments.

*Cherokee Reservation, North Carolina.*—James Mooney (No. 135186), pottery fragments.

*Savannah River, Richmond County, Georgia.*—H. L. Reynolds (Nos. 135192, 135215), vases and fragments; (135217, 135225) clay pipes; (135253) clay fragments; (135278, 135279) pottery fragments from mound.

*Bear Point, Perdido Bay, Baldwin County, Alabama.*—Mrs. A. T. Mosman (Nos. 135285, 135289), vases and fragments.

*Bear Point, Perdido Bay, Baldwin County, Alabama.*—A. B. Simons (Nos. 135292, 135312), vases and fragments.

*Espanola, New Mexico.*—Arthur Davis (No. 135314), pottery fragments.

*Yuma, Arizona.*- Dr. George M. Kober (Nos. 135315, 135317), earthen vessels.

*Elgin County, Canada.*—Charles B. Tweedale (No. 135318), earthen pipe-bowl; (135329) pottery fragments.

*Sila, New Mexico.*—Mrs. James Stevenson (Nos. 135345, 135346), pottery vases.

*Casa Grande, Arizona.*—V. Mindeleff (Nos. 135349, 135350), pottery fragments.

*Ancient Pueblo, Salt River Valley, Arizona.*—V. Mindeleff (No. 135352), pottery fragments.

*Hughes County, South Dakota.*—H. L. Reynolds (No. 135359), pottery fragments.

*Barton County, Georgia.*—H. L. Reynolds (No. 135362), pottery fragments.

*Souris River, southwest Manitoba.*—H. L. Reynolds (No. 135363), pottery fragments.

# REPORT ON THE SECTION OF ORIENTAL ANTIQUITIES IN THE U. S. NATIONAL MUSEUM, 1890.

By CYRUS ADLER, *Assistant Curator*

In the absence in Europe of Prof. Paul Haupt, honorary curator of the section, I beg to submit the following report for the past fiscal year.

The collections exhibited are still confined to Babylonian, Assyrian, and Egyptian objects, and the considerable amount of material now in the Museum which would naturally come under the heading of Biblical Archæology is exhibited in other departments. Possibly the most gratifying results of the year's work, the character of which did not differ from the preceding one, is the increased coöperation of other institutions and of individuals, and the aid which the Smithsonian Institution has been enabled to extend to the recently established museums and to scientific investigators.

The authorities of the Catholic University of America (Washington, D. C.), recently inaugurated, have established an oriental museum. They have adopted the Museum standards and a healthy coöperation has been established.

The growing interest in oriental studies has resulted in the formation of a private class in Washington, whose investigations have been aided by photographs and objects belonging to the collections.

The fact of the participation of the Smithsonian Institution in the Eighth International Congress of Orientalists, which met at Stockholm in September, 1889, was briefly alluded to in the last report.

At the request of Count Carlo Landberg, the secretary of the congress, the Smithsonian Institution published a special circular for American scholars, containing information as to the meetings. The Institution presented on behalf of the Museum to the King of Sweden, president of the congress, a set of reproductions of Assyrian seals, illustrating the methods employed. These objects were highly commended by his majesty on their presentation; General Thomas, United States minister to Sweden, transmitting a communication to that effect. The Smithsonian Institution was represented at the congress by Professor Haupt, whose report to the Secretary will be found elsewhere.

The American Oriental Society has appointed a committee to prepare a catalogue of the oriental manuscripts in the United States. A member of the committee learned of a collection, numbering, it is said, 160 Persian and Arabic MSS., formed by the late William B. Hodgson. They were traced to the Telfair Academy of Arts and Sciences in Savannah, Georgia, and, after some correspondence, the trustees of that institution passed a resolution authorizing the director to forward the MSS. to the Smithsonian Institution, on deposit, for study.

Mr. Talcott Williams, of Philadelphia, while on a tour through Morocco, undertook to make a collection for the Museum. Among the objects thus acquired are many illustrating the manners and customs of the inhabitants of that country.

The preparation of the Smithsonian Report on the Progress of Oriental Science in America during 1888 necessitated correspondence with many of the orientalists of the United States, resulting in useful additions to the sectional library.

## ACCESSIONS.

Through the good offices of the Hon. Oscar S. Straus, formerly U. S. minister to Turkey, and the courtesy of Prof. Howard Osgood, of Rochester, New York, the Museum has come into possession of a cast of the famous Temple inscription discovered by the French archæologist, Clermont-Ganneau, May 26, 1871, and now in the Imperial Museum at Constantinople. The inscription reads: "No stranger is to enter within the balustrade round the Temple and inclosures. Whoever is caught will be responsible to himself for his death." In the account of Herod's Temple by Josephus (Antiq., xv, 11, 5) an inscription is mentioned which forbade "any foreigner to enter the inclosure on pain of death." And in a second description (Wars, v, 5, 2) he states that the warnings were written "some in Greek and some in Roman letters." Through this discovery light is also thrown on the episode in Acts XXI, 28–31, where Paul was accused of bringing Trophimus, an Ephesian, within the balustrade, and "all the city was moved and the people ran together, and they laid hold on Paul and dragged him out of the Temple, and they were seeking to kill him." According to Clermont-Ganneau, this is the most ancient as well as the most interesting Greek inscription which archæological investigation in Jerusalem has produced.

Mr. Theodore Graf, of Vienna, presented to the Museum a set of photographs and a selection of heliogravures of his collection of Græco-Egyptian portraits. The originals were discovered near Fayum at a place called Rubaiyet, in July, 1887. In producing these portraits the brush was not used, the encaustic or distemper processes being resorted to. The artist who practiced the encaustic process first spread a mixture of pure beeswax and liquid balsam over a smooth surface, on which the colors were laid in the form of a mosaic. The different colors were then blended together by means of the cestrum, a spoon-shaped instrument, the bowl of which had serrated edges, while the handle was rounded. The portraits, painted in distemper, were executed in a composition consisting of the yolk of an egg, a little oil, and the required powdered colors. Still another process was to mix oil and color powder together and put it on in a molten condition. Some of the pictures show that all three processes were employed. It is difficult to determine the date at which these paintings were executed, but it must have been some time between 100 and 350 A. D. The portraits were probably painted from life. The collection exhibits notably the different types of countenance and the methods of dressing the hair. The originals are still for sale and would be a great addition to any antiquarian collection.

Dr. R. Zehnpfund, of Leipzig, presented an imitation of an Assyrian clay tablet, written by himself, containing a hymn in praise of wine, in the style of the Nimrod epic composed by Professor Haupt, of Johns Hopkins University, Baltimore. The tablet was made out of a lump of clay which, after being carefully sifted, washed, and cleaned, was moistened, rolled up in the form of a cylinder, and then flattened on a board. When the clay became sufficiently dry so that it would not adhere to the stylus, the tablet received the necessary polish by being rubbed against a smooth, flat board. The stylus used for writing consisted of a four-cornered piece of hard-oiled wood, the front end of which was cut off slanting. Writing with this instrument was easy and did not occupy much time. It took little more than an hour to write this tablet.*

Rev. Dr. William Hayes Ward, of New York, permitted copies to be made of twelve Babylonian and Assyrian seals in his collection. Ten similar objects were received from Prof. D. G. Lyon, of Harvard University, and eighteen Assyrian, Babylonian, Persian, and Egyptian gems from Prof. H. Hyvernat, of the Catholic University.

A series of photographs was purchased from the Palestine exploration fund.

### DISTRIBUTIONS.

Casts of forty Assyrian seals were presented to the University of Pennsylvania; a similar collection was sent to Prof. Howard Osgood, of the University of Rochester, New York. Ten casts of Assyrian seals were sent to Prof. D. G. Lyon, Harvard University, and two to Dr. Ward. Copies of the Canopus Inscription were forwarded to Lehigh University and to the Chinese minister.

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* The text with translation was published in the "Menu du dîner offert au VIII° Congrès International des Orientalistes," Stockholm le 7 sept. 1889.

## ROUTINE WORK.

During the year the collections were rearranged, with the object of securing more space. The seals, copied from the originals owned by the Misses Bruce and Prof. O. C. Marsh, of New Haven, referred to in the last report, were labeled and placed in the exhibition cases. The photogravures of the Græco-Egyptian portraits and the copies of the seals of Dr. Ward, referred to above, have been placed on exhibition.

A complete series of the casts of seals is preserved in the study series.

In addition to the persons mentioned above, the Museum is indebted for coöperation and assistance to Mr. Henry Gillman, United States consul at Jerusalem, Mr. W. Max Müller, and Dr. F. C. H. Wendel, of New York.

# REPORT ON THE HISTORICAL COLLECTIONS IN THE U. S. NATIONAL MUSEUM, 1890.

By A. HOWARD CLARK, *Curator.*

The transfer of a large collection of relics of General Washington from the Patent Office to the National Museum in 1883 was the beginning of a separate section devoted to historical collections. With the Washington relics were grouped many objects heretofore exhibited in other departments of the Museum, but which are of more interest as personal relics of representative men or memorials of events or places of historic importance. Here were brought together various gifts from foreign governments to Presidents Jefferson, Adams, Van Buren, Commodore Perry and other high officials of the United States, besides relics of Benjamin Franklin, Andrew Jackson, Abraham Lincoln, General Ripley, Commodore Elliott, Commodore Biddle, and many other eminent American statesmen and soldiers, as well as numerous manuscripts and relics pertaining to the colonial and revolutionary war period of our country, and mementoes of Sir John Franklin, Kane, Hayes, Hall, De Long and other Arctic explorers. In November, 1886, the large collection of relics of General Grant were received and added very greatly to the popular interest in this section of the Museum.* The growth of the historical collections in the past three years has been very rapid, and the space devoted to this class of exhibits is found far too limited for their display to visitors. The collections exhibited in the north hall have been partially rearranged and many new objects have been installed during the year. Labels have been written for all objects shown. There are now in reserve many hundreds of objects that might be exhibited if space permitted.

A beginning has been made on a collection of postage stamps of all nations, about 1,600 specimens gathered by Professor Baird forming the nucleus of this collection.

The collection of portraits of representative men of the world has increased considerably in number during the year, but is yet very incomplete. There have been put on exhibition engraved and photographic portraits of some of the most eminent scientists, and an interesting collection of portraits of the medical men of the world deposited by Dr. J. M. Toner.

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*A list of these objects is given in the Annual Report for 1887.

The collection illustrating the moneys of the world in all ages and countries has been an addition of popular interest, as is evidenced by the many valuable loan collections of ancient and modern pieces. This collection is not limited to metallic currency, but includes paper currency and various substitutes for money.

The entries in the catalogue during the year aggregate 645, representing about 1,000 specimens. Upwards of 3,000 additions have been made to the card catalogue, which now numbers about 10,000 cards. There are yet many objects not catalogued in detail, though accession cards and lists are preserved.

The accessions during the year were as follows:

From Charles Abert, Homewood, Maryland, a marble bust of Benjamin Franklin, sculptured by Ceracchi, in Italian marble.

From Nathan Appleton, Boston, Massachusetts, a gun-carriage from the citadel of Santo Domingo City, made of mahogany, probably by the Spaniards during the early days of their possession of the island. Also photograph of Sitting Bull and other Indians at Standing Rock, and photograph of the General Custer Monument on the battlefield at Little Big Horn River, Montana. Only one officer's remains were buried on the battlefield—young Lieutenant Crittenden. His father, General Crittenden, said, "Bury him where he fell on the field of battle."

From Fred J. Adams, Grand Rapids, Michigan, badge of the Michigan Press Association at their session in Grand Rapids, in July, 1889.

From W. S. Baker, Philadelphia, Pennsylvania, four volumes on engraved, medallic, and character portraits of Washington, "Bibliotheca Washingtoniana," and "History of a rare Washington Print."

From F. N. Barrett, New York City, portrait of M. Appert, inventor of the art of preserving food by hermetic sealing.

From Miss H. H. Berger, Brooklyn, New York, copper and silver coins of Finland.

From Paul Beckwith, Washington, District of Columbia, badge of Union Veterans' Union, Good Templars, Knights of Pythias, and Knights of Golden Eagle; also one book, "The Spellbinders' Souvenir," and medals commemorating the unveiling of General Meade statue, 1887, and the organization of First Regiment National Guard of Pennsylvania, 1861.

From Dr. E. G. Betty, Cincinnati, Ohio, medals of Ohio Valley Centennial Exposition, and rare silver, copper, and nickel coins of the United States.

From J. S. Billop, Glenn Dale, Maryland, half-penny of Virginia, George III, 1773.

From H. P. Branham, glass flute, silver-mounted, made by Laurent, of Paris, and used for many years by Judge A. B. Longstreet, of Georgia, author of History of Georgia, etc.

From the British Museum, London, a large series of electrotypes of Greek coins, the types of coins used prior to 100 A. D.

From F. E. Brownell, Washington, District of Columbia, shotgun and rifle, relics of Col. E. E. Ellsworth.

From Mrs. J. G. Bruff, Washington, District of Columbia, collection of 1,129 silver and copper coins of the United States and foreign countries, 171 examples of paper currency, 29 medals, and some numismatic books.

From Harriet W. Cary, Napoleon, Ohio, a looking-glass, relic of James Mason, of the Plymouth Colony.

From Mrs. S. S. Cox, New York City, decorations of the Turkish Order of the Mjidieh and the Shefaket.

From William Ellory Curtis, Washington, District of Columbia, album of portraits of the officers and members of the International American Conference held at Washington in 1889-'90.

From Joseph A. Donahoe, San Francisco, California, comet medal of the Astronomical Society of the Pacific, given to discoverers of comets.

From Leon C. Duchesne, Natchez, Mississippi, paper-money of the city of Natchez, November, 1862.

From R. Edward Earll, Washington, District of Columbia, six-kreutzer coin of the Rhenish Palatinate, dated 1808.

From George L. Eckert, Washington, District of Columbia, copper coin of State of Chihuahua, Mexico.

From St. Julian Fillette, Washington, District of Columbia, photographs of United States war ships *Trenton*, *Vandalia*, and *Nipsic*, and the war ship *Ogla*, showing view of the harbor of Apia, Samoan Islands, taken after the hurricane of Saturday, March 16, 1889.

From Charles F. Fish, Fall River, Massachusetts, photographs of the old stone mill at Newport and of an old windmill at Portsmouth, Rhode Island.

From Joseph Francis, Minneapolis, Minnesota, large gold medal presented to Mr. Francis by President Harrison, April, 1889, in accordance with act of Congress of the United States for his invention of lifeboats, etc. Gold snuff-box, diamond mounted, presented to Mr. Francis by Napoleon III.

From James M. Gleason, Boston, Massachusetts, bronze medals commemorative of the visit of the Boston Commandery to the Twenty-fourth Triennial Conclave of Knights Templar, Washington City, October 8, 1889.

From Rev. A. K. Glover, Grand Haven, Michigan, copper coins of the United States from 1783 to 1826.

From Guildhall Library Committee of London, England, bronze medals struck by order of the Corporation of London, from 1849 to 1887, to commemorate various historic events.

From William M. Haley, San Francisco, German Bible printed in Halle in 1765, and German passport issued to K. Land in May, 1837.

From William Hall, Winnipeg, Manitoba, Canada, Knights Templar badge and card.

From Mrs. W. S. Hancock, Washington, District of Columbia, cane presented to General Hancock by citizens of Brooklyn, in 1884; sword voted to him at the Sanitary Fair in St. Louis in 1864, and regulation sword carried by him throughout the war of the rebellion.

From Mrs. Mary Harney, Washington, District of Columbia, Mexican saddle and harness, military cap and chapeau, epaulettes, revolver, and two rifles, personal relics of Gen. W. S. Harney.

From W. T. Hornaday, Buffalo, New York, plaster bust of Professor Huxley.

From C. P. Jacobs, Indianapolis, Indiana, programmes, invitation cards, badges, and other relics of the funeral of President Abraham Lincoln.

From Philip Jaisohn, Washington, District of Columbia, Japanese 20 sen silver coin.

From Lewis Johnson & Co., Washington, District of Columbia, Hungarian paper money, issued at Buda-Pest, September 1, 1848.

From J. P. Klinges, Philadelphia, Pennsylvania, postage stamps of the Confederate States.

From Oliver S. League, Annapolis, Maryland, cross-bow found under the floor of Colonel Wilmot's house in Annapolis, built in the seventeenth century.

From Thomas Marron, Washington, District of Columbia, autograph letter of Postmaster-General Amos Kendall, October 26, 1838.

From Col. Marshall McDonald, Washington, District of Columbia, military publications and manuscript records pertaining to the Confederate States.

From Mrs. N. V. D. Miller, reprints of wall paper edition of Vicksburg Daily Citizen, July 2-4, 1863, and reprint of Ulster County Gazette, January 4, 1800.

From Theodore A. Mills, Washington, District of Columbia, commission of Clark Mills as lieutenant of cavalry in 1853, signed by President Franklin Pierce and Jefferson Davis, Secretary of War. Cast of face of Abraham Lincoln, from original mold made by Clark Mills in February, 1865, about sixty days before the President's death.

From W. C. Mason, Washington, District of Columbia, Chinese copper coins.

From John M. Noah, Washington, District of Columbia, original printed copy of Carriers' address to the patrons of the National Advocate, New York City, January 1, 1817. Badge of Knights Templar.

From William S. Overton, Stony Creek, Virginia, pardon for rebel soldier signed by W. H. Seward, Secretary of State, July 5, 1866.

From Gen. Walter A. Payne, Fostoria, Ohio, badge of the Sons of Veterans.

From Thomas G. Reames, Jacksonville, Oregon, twenty-dollar gold coin of the United States found in a cow's stomach. Badge of Knights Templar.

From J. T. Richards, Philadelphia, Pennsylvania, brick from foundation of Fort Duquesne, at Pittsburgh, built prior to 1753.

From W. W. Rockhill, Washington, District of Columbia, Chinese paper-money, including a national-bank note, the only issue by the present dynasty, and New Year's Day and ordinary 100-cash paper currency of the city of Pekin.

From Arthur E. Scarff, Kalamazoo, Michigan, Siamese copper coin, and copper coin, dos centavos, of Argentine Republic, 1884.

From Henry L. Sheldon, Middlebury, Vermont, paper-money of Vermont Glass Company, 1814, and fractional currency of H. A. Sheldon, 1862.

From Felix Speyer, Franklin, Pennsylvania, copper coin of Portugal, 20 reis, 1866.

From Dr. H. R. Storer, Newport, Rhode Island, molds of medals of historic interest.

From Tiffany & Co., New York City, silvered copper electrotype of the large vase presented to William Cullen Bryant by the citizens of New York in 1875.

From James Todd, Pittsburgh, Pennsylvania, silver watch and seal and pendant, captured from a British soldier at battle of Lexington, 1775, by Lieut. James Todd, of Boston.

From War Department, two swords presented to Gen. James Shields by State of Illinois and State of South Carolina, for gallant services during the Mexican War.

From W. J. Winter, Denver, Colorado, ribbon badge of the Cowboy Club of Denver, Colorado.

From A. F. Wooster, Norfolk, Connecticut, copper coin of Republic of Spain, 1870.

The morning sessions of the annual meeting of the American Historical Association were held in the lecture hall of the National Museum December 28 to 31, 1889. There was a large attendance of members of the association and much interest was manifested in the Museum collections. This Association was incorporated by act of Congress approved January 4, 1889, and by this act is directed to report annually to the Secretary of the Smithsonian Institution concerning its proceedings and the condition of historical study in America. The Regents of the Smithsonian Institution are authorized to permit the Association to deposit its collections, manuscripts, books, pamphlets, and other material for history in the Smithsonian Institution or in the National Museum. Under this act some books and pamplets have been deposited in the Museum and placed in charge of the curator of the historical collections, who has been elected assistant secretary and curator of the Association, Among the papers read at the annual meeting were the following:

Literature of Witchcraft. By Prof. George L. Burr, of Cornell University.

A Catechism of Political Reaction. By Ex-President Andrew D. White.

The French Revolution in San Domingo. By Herbert Elmer Mills, of Cornell University.

On a Newly Discovered Manuscript called Reminiscences of the American War of Independence, by Ludwig Baron von Closen, aid to the Count de Rochambeau. By Clarence W. Bowen, of New York City.

Recent Historical Work in the Colleges and Universities of Europe and America. By President Charles Kendall Adams.

The Origin and Early History of our National Scientific Institutions. By Dr. G. Brown Goode.

The Development of International law as to Newly Discovered Territory. By Dr. Walter B. Scaife, of Johns Hopkins University.

The Impeachment and Trial of President Johnson. By Dr. William A. Dunning, of Columbia University, New York City.

The Trial and Execution of John Brown. By Gen. Marcus J. Wright.

A Defense of Congressional Government. By Dr. Freeman Snow, of Howard University.

The Economic and Social History of New England, 1620–1789. By William B. Weeden, of Providence.

The Correspondence of the Pelham Family and the Loss of Oswego to the British. By William Henry Smith, president of the Associated Press.

The early History of the Ballot in Connecticut. By Prof. Simeon E. Baldwin of Yale University.

Certain Phases of the Western Monument during the Revolutionary War. By Theodore Roosevelt.

The Concentration of the Flathead Indians upon the Jocko Reservation. By Gen. Henry B. Carrington.

The Constitutional Aspect of Kentucky's Struggle for Autonomy, 1784–'92. By Ethelbert D. Warfield, president of Miami University.

Some Historical Facts from the Records of William and Mary College. By President Lyon G. Tyler.

Materials for the Study of the Government of the Confederate States. By John Osborne Sumner.

Notes on the Outlook for Historical Studies in the Southern States. By Prof. William P. Trent, of the University of the South.

The Relations of History to Ethnology. By Prof. O. T. Mason, of the National Museum.

The Present Condition of Historical Studies in Canada. By George Stewart, jr., D. C. L., LL. D., of Quebec.

The Spirit of Historical Research. By James Schowler, of Boston.

The Perils of Historical Study. By Justin Windsor.

The Government as a Guardian of American History. By Worthington C. Ford.

A full report of the proceedings of the meeting will be printed in the annual report of the Association, which will be published as a Congressional document.

# REPORT ON THE SECTION OF GRAPHIC ARTS IN THE U. S. NATIONAL MUSEUM, 1890.

By S. R. KOEHLER, *Curator.*

**The re-arrangement of the collections of the Section of Graphic Arts, which was alluded to as impending in my last report, has been carried out. The details of this arrangement are set forth on the leaflet printed for the information of visitors to the Museum, and here reprinted.**

## *CLASSIFICATION OF EXHIBITS IN THE SECTION OF GRAPHIC ARTS.*

The collections exhibited in the Hall of Graphic Arts illustrate the various methods of producing pictures on flat surfaces, by hand, as well as by mechanical means. They form two main groups, the one technical, the other historical.

On the eastern side of the hall, opposite the windows, are arranged the specimens illustrating the technical methods of the reproductive or multiplying arts; that is to say, those arts that produce blocks, plates, etc., from which impressions can be obtained in the press, such as wood-engraving, engraving on metal with the graver or burin, etching, mezzotinting, lithography, the modern photomechanical processes, etc.

On the western or window side are illustrated the various methods of drawing and painting, the history of painting (by means of carbon prints, etc.), and the history of engraving in relief (wood-engraving, etc.), intaglio (engraving with the burin, etc.), and of drawing on stone, etc. (lithography). On the same side of the hall will also be found illustrations of the history of color-printing, and supplementary exhibitions illustrating aids to drawing used by lithographers and draftsmen for process-work, methods of enlarging and reducing, etc., and industrial applications of printing.

The collections are arranged in alcoves in the following order:

### *EASTERN SIDE OF THE HALL.*

### BEGINNING AT THE SOUTHERN END.

*Alcove* 1.—Typical illustrations of the methods used in the production of printable blocks and plates.—Relief-engraving (the wood-cut, wood-engraving, relief-engraving on metal): Tools, materials, and appliances. Proving and printing. Electrotyping. Original drawings, etc., with the engravings made from them.

*Alcove* 2 (southern side and wall).—Relief-engraving continued: Color-printing from relief blocks. Japanese wood-cutting and wood-cut printing (including the case placed in the alcove).

*Alcove* 2 (northern side).—Intaglio-engraving: Tools, materials, and appliances. The various methods of intaglio-engraving (burin or graver work, etching, dry-pointing, etc.).

*Alcove* 3.—Intaglio-engraving continued: The various methods continued (soft-ground etching, aquatint, mezzotint, roulette work, stipple, mixed manner, color-printing, intaglio on wood, etc.). Proving and printing. Electrotyping and steel-facing, etc. (The case placed in this alcove contains the Saxton engraving machine. For specimens of work done on it, see the wing-frames on the standard between alcoves 4 and 5.)

*Alcove* 4.—Lithography: Tools, materials, and appliances. The various methods of lithography (crayon, pen-and-ink, engraving, brush-work, color-printing, etc.). Transferring. Printing.—Zincography.—On the wall above the alcove: A chromolithograph in its various stages.

*Standard between alcoves* 4 *and* 5.—Miscellaneous processes, partly chemical, partly mechanical, devised as substitutes for the older hand processes, but not involving photography: Chalcotype, Comte process, Gillot process, etching in relief (typographic etching, properly so-called), chemitype, the graphotype, the kaolatype, the wax process and allied processes (glyphography, kerography, stylography, typographic etching improperly so called, etc.), machine relief-engraving, machine intaglio-engraving (medal-ruling), galvanography, stenochromy, mineralography, nature printing, the anastatic process, etc.—Appendix: Etching on glass (improperly so called), which involves photography, but not the use of the press.

*Alcove* 5.—Photo-mechanical processes, involving the production of gelatine or other glutinous films, to be used as printing surfaces in the lithographic press, *i. e.*, collographic or photo-gelatine printing processes (albertype, heliotype, artotype, etc.).

*Alcove* 6.—Photo-mechanical processes producing relief blocks for printing in the type-press (etching, swell gelatine, and washout processes): line processes. Half-tone processes, *i. e.*, gelatine grain processes (Paul Pretsch's and later); screen processes (Meisenbach, etc.); the Ives process.

*Alcove* 7.—Photo-mechanical processes involving the production of printable designs on stone or zinc, *i. e.*, photolithography and photozincography: Half-tone processes (the bitumen process, Poitevin's process, Asser's process, etc.; recent grain processes; screen processes). Line processes (Osborne's process).

*Alcove* 8.—Photo-mechanical processes producing intaglio-plates for printing in the copper-plate press, *i. e.*, photogravure: Etching processes, deposit processes, etc. (Fox Talbot's, Paul Pretsch's and later processes).—The Woodbury type: films, molds, and impressions.

### *WESTERN SIDE OF THE HALL.*

#### BEGINNING AT THE SOUTHERN END.

*Alcove* 1.—Drawing and painting: Metal-point, lead-pencil, crayon, pastel, charcoal, pen-and-ink, India ink, sepia, miniature painting on ivory, water-color painting, oil-painting. Appendix: Blot pictures, silhouettes, scissors pictures, stenciling, etc.—The monotype.—Illustrations of the history of painting (by means of carbon prints, etc.).

*Alcove* 2.—Relief-engraving (the wood-cut, wood-engraving, relief-engraving on metal): Historical illustrations from the fifteenth century to the present time.

*Alcove* 3.—Intaglio-engraving (burin or graver work, dry-pointing, imitation of crayon, stipple, mezzotint, etc.): Historical illustrations from the fifteenth century to the present time.

*Alcove* 4.—Intaglio-engraving continued (etching, soft-ground etching, aquatint): Historical illustrations from the sixteenth century to the present time.

*Alcove* 5.—Lithography: Historical illustrations from the beginning of the nineteenth century to the present time.

*Alcove* 6.—Color-printing: Historical illustrations from the sixteenth century to the present time. (Relief-engraving: the old chiaroscuros; modern wood-engraving. The Baxter process. Intaglio-engraving: Printed at one impression, *i. e.*, from the plate rubbed in in different colors; printed from several plates. Stenochromy. Chromolithography. Wax process, etc. The modern photo-mechanical processes applied to color-printing.)

*Alcove* 7.—Aids to drawing used by lithographers and draftsmen for process work: Grained and embossed papers; pasting tints; the air-brush; Day's shading mediums, etc.—Methods of reducing and enlarging: The pantagraph; rubber machines; photo-mechanical processes.—Industrial applications of printing: Printing on wood, celluloid, metal, glass, etc.

NOTE.—Some of the items named in above list have not yet been placed on exhibition, but space has been reserved for all, and they will be added as soon as possible.

A beginning has also been made with the labeling of the collections, but the greater part of the manuscript for labels sent in thus far is still in the hands of the printers. The collection of patents relating to the graphic arts is in the same condition in which it was a year ago, both time and money having been wanting to carry it on towards completion and classification.

The most important accession of the year has been the collection of tools, materials, prints, etc., illustrating the practice of chromoxylography in Japan, generously donated to the Museum by the Japanese Government printing office (Insetsu Kioku) in Tokio, through its chief, Mr. T. Tokuno. The very interesting descriptive matter which accompanied this collection will be published as soon as certain further information asked for has been received from Japan and the necessary illustrations prepared. A large collection of drawings by pupils of the Art Academy of Cincinnati, presented by the Cincinnati Museum Association, also deserves special mention here. In the technical division, the exhibits illustrating dry-pointing, soft-ground etching, engraving in intaglio on wood, and the wax process have been satisfactorily completed. Much, however, remains to be done, more especially in the divisions of drawing and painting and in the technical illustration of the various photomechanical processes. The list of donations, herewith submitted, shows, indeed, that a considerable number of specimens exemplifying the results of these processes have again been acquired, but it is very difficult, under present circumstances, to secure the means of explaining the processes themselves.

## LIST OF ACCESSIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1890.

### ACQUIRED BY GIFT.

Andrews, John & Son, Boston, Massachusetts. Two wood-engravings, executed in the establishment of the donors. (Cat. Nos. 3240, 3241.)

Avery, S. P., New York, New York. Collection of etchings, lithographs, and Procédé Comte prints. (Cat. Nos. 3007-3022, 3234.) Catalogue, "Atelier Jules Dupré," Paris, 1890.

Bencke, H., Lithograph Company, New York. Half-tone photolithographs, etc., executed in the establishment of the donors. (Cat. Nos. 2945, 2954.)

Berger & Wirth, New York. Specimen of prepared zinc for zincography. (Cat. No. 3109.)

Buehring, Fred., New York. Lithographers and Photographers' Directory for 1889. (Cat. No. 2895.)

Chandler, Prof. C. F., New York, New York. Collection of prints by various photomechanical processes. (Cat. Nos. 2900-2929.)

Chapman, J. Linton, Brooklyn, New York. Specimens of wood-engraving, glyphography, and medal-ruling. (Cat. Nos. 3235–3239.)

Cincinnati Museum Association, Cincinnati, Ohio. Drawings by pupils of the Art Academy of Cincinnati, in charcoal, crayon, pencil, pen-and-ink, sepia and water-colors. (Cat. Nos. 3026–3075.)

Day, Benjamin, New York, New York. Specimens of pasting-tints manufactured by the donor. (Cat. No. 3244.)

Devoe, F. W., & Co., New York, New York. Priced catalogue of artists' materials. (Cat. No. 3107.)

Fuchs & Lang, New York, New York. One lot of catalogues, circulars, etc., of lithographic materials, etc. (Cat. No. 3108.)

Gutekunst, F., Philadelphia, Pennsylvania. Specimens of collographic printing, executed in the establishment of the donor. (Cat. Nos. 3431–3433.)

Harvard University, Cambridge, Massachusetts. A bibliography of Hogarth. By Frank Weitenkampf. (Cat. No. 3413.)

Heliotype Printing Company, Boston, Massachusetts. Heliotypes and half tone photolithographs, executed in the establishment of the donors. (Cat. Nos. 2955–2959, 3131–3138, 3242–3243.)

Johnson, Charles Eneu, & Co., Philadelphia, Pennsylvania. Collection of varnishes, oils, pigments, etc., illustrating the composition and making of printing inks. (Cat. Nos. 3079–3104.)

Juengling, F., New York, New York. Engraved block, with electrotype, and impressions from it, illustrating the method of engraving on wood in intaglio. (Cat. Nos. 2959–2961, 3023–3624.)

Kimmel & Voigt, New York, New York. Four impressions from a dry-ground aquatint plate. (Cat. Nos. 3453–3456.)

Koehler, Miss Hedwig J., Roxbury, Massachusetts. Two psaligraphic pictures. (Cat. Nos. 2938–2939.)

Koehler, S. R., Roxbury, Massachusetts. Etchings, wood-engravings, etc. (Cat. Nos. 2969–3006.)

Kunz, Geo. F., New York, New York. Specimens of mineralography. (Cat. Nos. 3226–3228.)

Kurtz, William, New York, New York. Specimens of half-tone process work in relief, executed in the establishment of the donor. (Cat. Nos. 3465–3470.)

Macdonough, James, President American Bank-Note Company, New York, New York. Specimen of bank-note engraving. (Cat. No. 3464.)

Mayforth, Max, and Mrs. Chas. A. Krause, Washington, District of Columbia. Collection of etchings, engravings, and lithographs. (Cat. Nos. 3149–3207.)

McConnell, Dr. J. C., Washington, District of Columbia. Pen-and-ink drawing by the donor. (Cat. No. 3457.)

Miller, William, New York, New York. Specimens of India paper, etc., used in taking knife-proofs from wood-engravings. (Cat. Nos. 2964–2966.)

Osborne, J. W., Washington, District of Columbia. Collection of specimens of process work, engravings, lithographs, etc. (Cat. Nos. 3274–3412.) N. B.—This comprises only that part of the Osborne collection placed on exhibition. The larger part still remains to be classified and registered. Specimens of process work. (Cat. Nos. 3447–3449.) Photography in printing ink.—Pouncy's Patent Process.—By Thomas Sutton, B. A. London: 1863. (Cat. No. 3450.)

Pennsylvania Museum and School of Industrial Art, Philadelphia, Pennsylvania. Six designs by pupils, in pen-and-ink and in water-colors. (Cat. Nos. 2930–2935.)

Photo-Gravure Company, New York, New York. Specimens of half-tone photolithography executed in the establishment of the donors. (Cat. Nos. 3414–3425.)

Scientific Publishing Company, New York. One set of chromolithographic plates from Kunz's work on gems, published by the donors. (Cat. No. 3471.)

Shanks, P. M., & Co., London, England. Description and specimens of work done on Shanks' engraving machine. (Cat. No. 3105.)

Smillie, James D., N. A., New York, New York. Etchings, mezzotints, bank-note engravings, etc., mostly executed by the donor. (Cat. Nos. 3110-3117, 3230-3233, 3273, 3458-3463.)

Tokuno, T., Chief of Insetsu Kioku (Government Printing Office), Tokio, Japan. Collection of tools, blocks, pigments, prints, etc., illustrating the art of chromoxylography as practiced in Japan. (Cat. Nos. 3209-3219, 3434-3446.)

Trumble, Alfred, New York, New York. Specimens of intaglio-engraving on wood. (Cat. No. 3025.)

Tuchfarber, F., Co., Cincinnati, Ohio. Specimens of transferring lithographic impressions to metal, executed in the establishment of the donors. (Cat. Nos. 3076-3078.)

Weber, F., & Co., Philadelphia, Pennsylvania. Illustrated catalogue and price-list of artists' materials. (Cat. No. 3106.)

White, Dr. C. A., Washington, District of Columbia. Engraved portrait of Prof. Dr. G. vom Rath. (Cat. No. 3208.)

Wolfe, M., Dayton, Ohio. Specimens of half-tone relief-process work, made with the fine-line plates manufactured by the donor. (Cat. Nos. 3245-3251.)

### ACQUIRED BY PURCHASE.

Wunderlich, H., & Co., New York, New York. Engravings by Goltzius and Demarteau. (Cat. Nos. 2896, 3451.)

Keppel, F., & Co. New York. Mezzotints; Poker picture. (Cat. Nos. 2897-2899, 3452.)

Dejonge, L., & Co., New York, New York. Heliotypes in colors. (Cat. Nos. 2936-2937.)

Miller, William, New York, New York. Inkball and folder, used in taking knife-proofs of wood-engravings. (Cat. Nos. 2962-2963.)

Smillie, James D., N. A., New York, New York. A dry-point plate with a series of progressive proofs, and the tools used. (Cat. Nos. 3115-3122.)

Farrer, Henry, Brooklyn, New York. A soft-ground plate, with drawings, progressive proofs, and the pencil, etc., used. (Cat. Nos. 3220-3225.)

Bruff, Goldsborough, estate of, Washington, District of Columbia. One lithograph, one mezzotint, one plumbeotype. (Cat. Nos. 3252-3254.)

Cunningham, Roger, Kansas City, Missouri. Plates, tools, impressions, etc., illustrating the wax process. (Cat. Nos. 3255-3267.)

Dougal, William H., Washington, District of Columbia. A dry-ground aquatint plate, with proofs. (Cat. No. 3426.)

Greey, Mrs. E. M., New York, New York. Four sets of Japanese stencils. (Cat. Nos. 3269-3272.)

### BOOKS PURCHASED FOR LIBRARY AND BOOK-TABLE.

Hudson. Guide to Art Illustration. London, 1884. (Cat. No. 3123.)

Patents for Inventions. Abridgments of the specifications relating to printing. London, 1859. (Cat. No. 3130.)

Shaw. Manual of Electro-Metallurgy. 2d edition, London, 1844. (Containing illustrations of Palmer's glyphography.) (Cat. No. 3229.)

Wood. Modern Methods of Illustrating Books. New York, 1887. (Cat. No. 3124.)

Richmond. Grammar of Lithography. London (new edition). (Cat. No. 3125.)

Delaborde. Engraving. London, 1886. (Cat. No. 3126.)

Linton. Wood-engraving. London, 1884. (Cat. No. 3127.)

Wilkinson. Photo-engraving. New York, 1888. (Cat. No. 3128.)

Lalanne. A Treatise on Etching. Boston, 1880. (Cat. No. 3129.)

The number of the last catalogue entry for the year ending June 30, 1889, was 2894; that for the year ending June 30, 1890, is 3471; showing an increase during the year of 577 numbers. There still remains to be catalogued, however, by far the larger part of the Osborne Collection, the classification of which will also place at the disposal of the Museum quite a number of duplicates which may be used for exchanges.

A list of papers published by me during the year will be found in the Bibliography (section IV).

### RECOMMENDATION IN REGARD TO THE SEWALL COLLECTION.

I beg permission to urge again the recommendations made last year: notably, the desirability of definitely turning over to the Section of Graphic Arts the remains of the Marsh Collection, and of an appeal to Congress for a special appropriation for the purchase of the Sewall Collection of engravings, etc., in regard to which I have already addressed a letter to the Secretary of the Smithsonian Institution, which is here reprinted:

UNITED STATES NATIONAL MUSEUM,
UNDER DIRECTION OF THE SMITHSONIAN INSTITUTION,
*Washington, April* 17, 1890.

Prof. S. P. LANGLEY,
*Secretary of the Smithsonian Institution :*

DEAR SIR: In accordance with your request, I beg to submit herewith some details concerning the Sewall Collection of Prints now offered for sale in New York, and to state the reasons which induced me to recommend in my annual report that an appeal be made to Congress for a special appropriation for its purchase.

It appears from the figures given on the accompanying sheets that the collection consists of 16,300 prints (exclusive of 4,100 portraits and landscapes which the owner does not hold to be of sufficient importance to enumerate with the rest, although they are to be included in the sale) by over 1,400 artists of all schools and periods, from the beginning of the reproductive arts in the fifteenth century down to our own time. In addition to these prints there are 400 drawings.

In considering the question of the acquisition of such a collection, three things must be taken into account: (1) Its quality; (2) its character as a whole in relation to the history of the art of engraving, that is to say, its relative completeness or incompleteness; and (3) its price.

As to the quality of the Sewall collection, I can say from personal observation that it contains many very fine prints, together with others that are not so fine. The partial lists herewith submitted show that it is extraordinarily rich in the works of some of the most celebrated artists who have worked as etchers or engravers in past centuries. Thus, there are 294 pieces by Marcantonio and his school; 359 by Albert Dürer; 127 by Lucas van Leyden; 490 by the Little Masters; 359 by Rembrandt; 391 by Hollar; 227 by Goltzius and his school; 53 by Claude Lorrain; 433 by Jacques Callot; 82 by Nanteuil; 222 by J. G. Wille, etc. Nevertheless, I wish to have it distinctly understood that I have been able thus far to examine only a relatively small portion of the collection, and that, if a purchase should be contemplated, a more careful examination will be in order. Concerning the second point, it is evident, from the statements herewith, that the historical completeness of the collection, considering its size, is one of its most valuable qualities, since it presents to the student not only examples of all the processes of engraving practised by artists up to about the middle of the present century, but also specimens of all artists of sufficient note to make a knowledge of their work indispensable, with others by many men of less importance. This admirable, well-proportioned development of the collection is due to the fact that the present owner has been a systematic collector, having a well-defined aim in view, for the last forty years, and that especially within the earlier part of this period he has found it possible to secure specimens which are becoming rarer from year to year. In a connected series, such as the Sewall collection represents, even specimens not of the first quality assume great importance, since they supply links in a chain which would be broken without them. It would be inexcusable, therefore, to allow this collection to be dispersed, a fate which is inevitably in store for it if it is not acquired by some public institution.

Of the price asked it may be said without hesitation that it is extraordinarily low. The sum total demanded is $55,760, of which $560 is for the drawings. Ignoring the 4,100 pieces set aside by the owner as of no value, we have the price of $55,200 for 16,300 prints, or an average of $3.39 for each print. As many of these prints would to-day bring from one hundred to several hundred dollars each in open market, the smallness of the sum named is apparent from these figures alone. A better way, however, to arrive at some idea of the market value of the collection, will be to compare the prices set down in Mr. Sewall's inventory for a number of specified prints with the prices lately realized for the same prints at auction sales in Europe. I have tried to do this, by going over the inventory and selecting from it such prints as had appeared also in the Coppenrath sale, which took place in Europe last year, being careful to compare state with state, so far as that point could be settled. The result is that, if the whole collection were invoiced at prices equivalent throughout to those obtained for the prints involved at the sale named, the Sewall collection would be worth to-day about $145,000. It would not be safe, however, to accept this figure without further questioning. A comparison of the prints as to quality with those sold in Europe, and an extension of the calculation to the whole collection would, quite likely, tend towards a greater equalization of the figures in question. Nevertheless, it will probably be permissible to assume that the price asked does not represent more than about one-half of present market value. Looked at, therefore, from a mere money point of view, it is evident that the purchase of the collection would be a good investment. For it must be kept in mind that the prices of old prints are going up with alarming rapidity; and furthermore, that from the price actually named must be deducted the labor and expense of collecting, which, if a collection such as the Sewall were to be made up by purchases in the market, would be an item of very considerable magnitude.

As, however, the Smithsonian Institution is not a money-making concern, the question of price, although of great importance, is not the only one, or even the most important, to be considered; and it may therefore be worth while to devote a few moments to the question, whether the purchase of such a collection is in itself desirable?

If we are to be led by the example of others, that question must unhesitatingly be answered in the affirmative. All the nations of Europe have considered it necessary to establish national print collections, and to give careful attention to their keeping and continual enlargement. The British Print Room, the "Département des Estampes" at Paris, the Cabinets at Amsterdam and Brussels, the "Kupferstich-Sammlung der königlichen Museen" (Print collection of the Royal Museums) at Berlin, the Royal Print Cabinet at Dresden, are all institutions of world-wide celebrity, and the possessors of treasures of inestimable value, and of a magnitude that it is difficult to realize. The most extensive among them are the British Print Room, the possessions of which, so far as I know, have never been counted, the French "Département des Estampes," with something like two and a half millions of specimens, and the collection of the Royal Museums at Berlin, with over one million. Most, if not all, of these public collections began by the purchase of private collections such as that made by Mr. Sewall. The practical beginning of the Paris collection dates from the year 1667, when Colbert bought for the state the collection of Michel de Marrolles, Abbé de Villeloin, consisting of 123,400 pieces for 30,400 livres. The value of this collection was estimated by Henri Delaborde (in his book on the Département des Estampes), in 1875, at over one million, and as within the fifteen years which have elapsed since then, the prices of prints have risen enormously, the actual value to-day is much larger. In a similar way the Berlin collections, of much more recent origin, date from the purchase for the state in 1835, by order of the King of Prussia, of the von Nagler collection for the sum of 92,333 thalers, which included, however, a number of ceramic and other objects. But Wessely is quite right when he says, likewise in 1875 (in his book "Die Kupferstich-Sammlung," etc.), that the prints alone of the von Nagler collection were then worth at least ten times the sum paid for the collection as a whole; and again, in view of the further appreciation in prices since this statement was made, the present value is much greater than that assumed by Wessely. Compared with the Marolles and the von Nagler collections the Sewall collection naturally appears quite insignificant and the price asked comparatively high. But it must be recollected that the times have changed, and the chances for acquiring collections approaching anything like comparative completeness are growing less and less. Quite likely, indeed, if the present occasion should be allowed to pass by unused, a similar one will never offer again. But as it is absolutely certain that at some time or other the United States will feel the necessity of organizing a national print collection, it may be accepted as equally certain that the prices which will then have to be paid will be much greater for much less material. It is the experience of the Sibylline books over again.

It may be said, however, that what others have done is not necessarily a standard of action for the United States, and that we must follow paths laid out by ourselves. If the question involved were merely one of fashion or of taste, the objection would be well taken. It is a question, however, of educational facilities, from which will flow permanent advantages to the material and intellectual welfare of the nation, and seen in this light it will appear that the matter is peculiarly well fitted to be taken in hand by an institution for the dissemination of knowledge, like the Smithsonian. The uses of a print collection seem still to be misunderstood by the majority of people. Although such a collection may be made to minister exclusively, and always will minister to a certain extent, to the æsthetic delight of connoisseurs, this aspect of it is yet very far from being its only or even its most important one.* Naturally enough the student of the history of art will derive great benefit from such a collection, more especially in a country like ours, which can not possibly hope ever to possess in sufficient quantity the originals interpreted in prints. But, aside from the history of art, there is hardly a branch of human knowledge or human activity that is not represented in a print collection, for whatever man has aspired to, either intellectually or in the practical pursuits of life, he has sought to shape visibly in pictures, and ever since the invention of the reproductive arts it has been the endeavor of the engravers to multiply these pictures and to disseminate them broadcast. For the general historian, therefore, as well as for the students of the exacter sciences, a print collection, provided that it is well classified and catalogued, and liberally administered, is a perfect storehouse of information, supplementing and sometimes even excelling the library, since it presents immediately to the eye, that which words upon the printed page call up only dimly to the mind. Even the classes last named, however, do not exhaust the ranks of those benefited by a print collection. There is still to be considered the vast army of artisans, designers, and others engaged in the various industrial pursuits, to whom a print collection offers sources of information and inspiration which can not possibly be found elsewhere. The value of this aid to producers has been so thoroughly recognized in Europe, that in some of the leading capitals—in Vienna and in Berlin, for instance—special print collections have been organized, alongside of the general collections, the sole aim of which is to assist practical workers in the industrial arts.

These are the reasons which induced me to recommend that an appeal be made to Congress for a special appropriation for the purchase of the Sewall Collection, and I beg leave to reiterate this recommendation herewith.

I have the honor to be, very respectfully, yours,

S. R. KOEHLER,
*Curator of the Section of Graphic Arts.*

The Sewall Collection of Prints consists of 20,400 pieces, 4,100 of which, however, mostly portraits, landscapes, etc., the owner does not consider of sufficient importance to be named as an integral part of the collection, although they will eventually go with it. Of the remaining 16,300 about 15,000 are engravings and etchings; 990, woodcuts; 310, mezzotints; and 170, lithographs (these latter mostly early French, including specimens by Guerin, Gérard, Girodet, Delacroix, De la Roche, etc.). The collection (exclusive of the 4,100 prints above alluded to) is arranged in 55 portfolios and 10 volumes. The number of engravers, etchers, etc., represented in it is 1,400, exclusive of the works of absolutely anonymous artists (*i. e.*, artists not even known by a monogram).

The schools represented in it are the following:

The Italian, from the invention of the art, and the German until about 1850.

The Dutch and Flemish, the French, and the English, from about 1500 to the nineteenth century.

The Spanish, eighteenth and nineteenth century (Goya).

The American.

As some of the more important constituents the following may be named:

| | | |
|---|---|---|
| Italian: | | |
| Early masters, to about 1500 | | 179 |
| Marcantonio and his school | | 294 |
| Italian painter-etchers (the Caracci, Guido Reni, Spagnoletto, Schidoni, Salvator Rosa, Carlo Maratti, Giordano, Della Bella, Tiepolo, etc.) | | 544 |
| Bartolozzi, chiefly proofs | | 291 |
| Raphael Morghen, nearly all proofs | | 197 |
| Longhi, Garavaglia, Toschi, Anderloni, all proofs | | 90 |
| German: | | |
| Early masters (E. S., 3; F. v. B., 1) | | 4 |
| Martin Schongauer | | 28 |
| Israel van Meckenem | | 34 |
| Lucas Cranach, the elder and the younger, chiefly wood-cuts | | 72 |
| Albert Dürer— | | |
| Works on metal (including 18 portraits of him by various engravers) | 130 | |
| Woodcuts | 229 | |
| | | 359 |
| Copies from Dürer by various masters | | 182 |
| Lucas van Leyden | | 127 |
| The little masters (Aldegrever, the Behams, Altdorfer, Pencz, Bink, Virgil Solis) | | 490 |
| The Hopfers | | 24 |
| Wenceslaus Hollar | | 391 |
| G. F. Schmidt | | 26 |
| Amsler, Felsing, the Müllers, Mandel | | 15 |
| Dutch and Flemish: | | |
| Dirk van Staren | | 3 |
| The Wierixes (including 40 portraits) | | 236 |
| The van de Passes and Sadelers | | 115 |

| | |
|---|---|
| Dutch and Flemish—Continued. | |
| Goltzius and his school (Saenredam, Jan Müller, Matham, etc., including 25 portraits by Golzius himself) | 227 |
| Suyderhoef | 17 |
| Original etchings by Van Dyck, in various states | 35 |
| The School of Rubens (Pontius, the Bolswerts, Vorstermans, De Jode, etc.). | 149 |
| Cornelius and Jan de Visscher | 50 |
| Original etchings and dry-points by Rembrandt, including states | 359 |
| School of Rembrandt (Bol, Lievens, Van Vliet, etc.) | 169 |
| Adrian van Ostade, including states | 193 |
| Other Dutch and Flemish painter-etchers of the seventeenth and eighteenth centuries, including Paul Potter, Karel du Jardin, Van de Velde, Ruysdael, Nicholas Berghem, Jan Both, etc | 528 |
| Jacob Houbraken, mostly portraits, many of them proofs | 48 |
| French: | |
| Jean Duvet | 4 |
| Etienne Delaune | 25 |
| Th. De Leu, mostly portraits | 18 |
| Claude Lorrain, including states | 53 |
| Antoine Masson, mostly portraits | 12 |
| Robert Nanteuil, portraits | 82 |
| Jacques Callot | 433 |
| Gerard Edelinck, chiefly portraits | 35 |
| The Drevets, portraits | 27 |
| J. G. Wille | 222 |
| J. J. de Boissieu | 23 |
| C. C. Bervic, 7 proofs | 15 |
| Lignon, Richomme, Forster, Laugier, all proofs | 30 |
| Modern Etchers: Delacroix, Flameng, Jacque, Jacquemart, Corot, Millet, Rajon, etc | 542 |
| Clarles Meryon | 24 |
| Spanish: | |
| Goya | 12 |
| English: | |
| Hogenberg | 1 |
| Delaram, Payne, Marshall, Vaughan, portraits | 24 |
| William Faithorne, portraits | 72 |
| Robert White, portraits | 27 |
| George Vertue, portraits | 39 |
| William Woollett, nearly all proofs and first states | 70 |
| William Hogarth, early states | 182 |
| Robert Strange, proofs and early states | 23 |
| Richard Earlom, proofs | 15 |
| William Baillie, many proofs | 255 |
| William Sharp, 59 proofs | 69 |
| S. W. Reynolds, C. Turner Cousins, all proofs | 27 |
| Abraham Raimbach | 6 |
| George T. Doo, proofs | 15 |
| J. M. W. Turner, plates from the "Liber Studiorum" | 40 |
| George Cruikshank | 400 |
| F. Seymour Haden | 24 |
| American: | |
| A. B. Durand | 55 |
| James Smillie | 10 |
| J. McN. Whistler | 26 |

It is my duty also to call attention to the fact that a logical and systematic development of this section must remain an impossibility until the appropriation for purchases can be measurably increased. During the period embraced by this report there were expended for purchases for the Section of Graphic Arts about $175. The number of accessions and the condition of the collections in general demonstrate, indeed, that artists and publishers and other friends of the Museum are ever ready to aid it. But such aid can hardly be regulated, and can but rarely be turned into the most desirable channels. There are many things needed which can only be bought, and others which must be ordered with a definite view to the relation which they are to bear to other things, if they are thoroughly to fill their places. These limitations, as a matter of course, can not be enforced so long as dependence must be placed almost wholly upon gifts.

# REPORT ON THE SECTION OF TRANSPORTATION AND ENGINEERING IN THE U. S. NATIONAL MUSEUM, 1890.

By J. ELFRETH WATKINS, *Curator.*

The routine work in the Section of Transportation and Engineering has been prosecuted during the fiscal year 1889–'90 at such times as my duties in the Department of Property and Supplies would permit. A number of labels have been attached to specimens and groups in the exhibition series, which are arranged according to the classification published in the report of 1889.

While the accessions are less numerous than in previous years, they are no less important.

The collection of primitive vehicles, in the construction of which no iron or other metal has been used, was materially strengthened by the deposit of a Mexican cart, by Messrs. Schuttler & Hotz (through Mr. Martin Conrad), Chicago, Illinois. The specimen was obtained from Paso del Norte, where it had long been in use.

The method of constructing the sides of the body of the vehicle of cactus saplings held in place by a network of rawhide strips, is of the greatest interest to the archæologist as well as to the student of the history of transportation; while the rough wheels, without spokes or tires, hewn from the solid log, show the crude methods of the ancient wheelwright and the beginnings of the wheel vehicle.

The nucleus of a collection to illustrate the history of the development of the bicycle has been secured, through the construction in the Museum workshops of a model of the English "dandy horse"; and the acquisition of two of the old-fashioned "velocipedes" with two wheels of wood, made between 1860 and 1865. A number of drawings of bicycles constructed during the next ten years have also been obtained.

To the series illustrating the history of the stationary steam-engine a most valuable relic has been added. I refer to the portion of the cylinder of the first steam-engine erected on the Western Continent, which was deposited by the New Jersey Historical Society, who obtained it from Mr. David M. Meeker, of Newark, New Jersey. In a communication to Mr. Meeker from the Hon. Joseph P. Bradley,* one of the justices of the Supreme Court of the United States, the following statements are made, under date of September 20, 1875:

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* Justice Bradley married Mary, daughter of Joseph Coerten Hornblower, son of Josiah Hornblower, who brought the steam-engine to America in 1753.

> The steam-engine of which you possess a relic was, as you suppose, the first ever erected on this continent. It was imported from England, in the year 1753, by Col. John Schuyler, for the purpose of pumping water from his copper mine opposite Belleville, near Newark, New Jersey. The mine was rich in ore, but had been worked as deep as hand and horse-power could clear it of water. Colonel Schuyler having heard of the success with which steam-engines (then called fire-engines) were used in the mines of Cornwall, determined to have one in his mine. He accordingly requested his London correspondents to procure an engine, and to send out with it an engineer capable of putting it up and in operation. This was done in the year named, and Josiah Hornblower, a young man then in his twenty-fifth year, was sent to superintend it. The voyage was a long and perilous one. Mr. Hornblower expected to return as soon as the engine was in successful operation. But the proprietor induced him to remain, and in the course of a couple of years he married Miss Kingsland, whose father owned a large plantation adjoining that of Colonel Schuyler. The late Chief Justice Hornblower was the youngest of a large family of children which resulted from this marriage. Mr. Hornblower's father, whose name was Joseph, had been engaged in the business of constructing engines in Cornwall from their first introduction in the mines there, about 1740, and had been an engineer and engine builder from the first use of steam-engines in the arts, about 1720. The engines constructed by him and his sons were the kind known as Newcomen's engines or Cornish engines. That brought to America by Josiah was of this description. Watt had not then invented his separate condenser, nor the use of high pressure. But it is generally conceded that for pumping purposes the Cornish engine has still no superior.
>
> After 1760 the Schuyler mine was worked for several years by Mr. Hornblower himself. The approach of the war, in 1775, caused the operations to cease. Work was resumed, however, in 1792, and was carried on for several years by successive parties. It finally ceased altogether early in this century, and the old engine was broken up and the materials disposed of. The boiler, a large copper cylinder, standing upright, 8 or 10 feet high and as much in diameter, with a flat bottom and a dome-shaped top, was carried to Philadelphia. The relic in your possession was a portion of the cylinder, and was purchased by some person in Newark.
>
> In 1864 I met an old man named John Van Emburgh, then a hundred years old, who had worked on the engine when it was in operation in 1792. He described it very minutely and, I doubt not, accurately. It is from his description that I happened to know the kind of engine it was; although, from the date of its construction and the use to which it was put, there could have been but little doubt on the subject.
>
> What changes have been wrought in 125 years. What mighty power has been created on this continent in that time by the multiplication and improvement of the steam-engine. We may well look upon this relic with a sort of superstitious veneration, and looking forward as well as backward, wonder what another century will bring forth.

An important addition has also been made to the steamboat series by the authorities of Stevens Institute, Hoboken, New Jersey, who deposited two drawings, made by Fulton's hand, about 1807. One is a draft of the machinery of the historic steamboat, which he at first called the *Catherine of Clermont*. The other is a drawing of the *Chancellor Livingston*, another steamboat constructed by Fulton shortly after the *Clermont* was put in service.

A most interesting relic has been added to the series illustrating the history of the locomotive, namely, the original boiler of the locomotive

"Stourbridge Lion." This has been deposited by Messrs. Lindsay & Early, Carbondale, Pennsylvania. Upon the full-size model of this, the first locomotive to turn a driving-wheel upon a railroad built for traffic on the Western Continent, which was deposited in the National Museum several years ago by the Delaware and Hudson Canal Company, is a framed letter from Horatio Allen, who for sixty years was a conspicuous figure among American civil engineers. The letter reads:

> HOMEWOOD, SOUTH ORANGE, NEW JERSEY,
> *January* 18, 1888.
>
> DEAR SIR: In reply to your inquiries, I write to say that the locomotive known as the "Stourbridge Lion" was the first locomotive run on this continent.
>
> That the occurrence took place at Hornsdale, Pennsylvania, August 9, 1829, on the mine railroad of the Delaware and Hudson Canal Company.
>
> That the locomotive was one of three built for that company in England, in 1828, under my direction as to plans, which were received in the city of New York early in the year 1829.
>
> That, through circumstances not necessary to state, I ran the locomotive myself, a responsibility I had never undertaken before and have never repeated since.
>
> Thus, on this first movement by steam on railroads on this continent, I was engineer, brakeman, conductor, and passenger.
>
> HORATIO ALLEN.
>
> Mr. J. E. WATKINS,
> *Curator, National Museum, Smithsonian Institution.*

It is the intention to mount the boiler on the original driving-wheels, collected in 1888, and to replace many of the original parts, which are still in existence, and thus make as complete a restoration of this old locomotive as possible. The death of Horatio Allen, on the 31st of December, 1889, is greatly to be regretted. He had hoped to live to see the work of restoring the "Stourbridge Lion" accomplished, a matter in which he took the deepest interest.

Several valuable relics of the early days of the electric telegraph have been obtained; among them a piece of the original wire used by Alfred Vail* in his experiments at the Speedwell Iron Works, near Morristown, New Jersey, 1837-'43.

It was over this wire that the message "A patient waiter is no loser," was sent on January 6, 1838. The ability to send and decipher this message was the test by which Judge Stephen Vail (father of Alfred Vail) was induced to furnish funds to Morse and Vail, which enabled them to prosecute their researches and to construct the telegraphic machines which were used in experiments before the Congressional committee at Washington, which finally culminated in the appropriation of $30,000 by the general government for the construction of a telegraph line from Washington to Baltimore, in 1844.

A piece of the wire which formed a part of that original telegraph line, which ran from Mount Clare depot, Baltimore, to the Capitol at Washington, and over which the message, "What hath God wrought," was sent by Professor Morse, May 24, 1844, has been presented by Mrs. Amanda Vail, widow of Alfred Vail, the associate of Professor Morse, who received and deciphered that historic message at the Baltimore end of the line. The original telegraphic instrument by which the message was sent, has been in the collection for some time.

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* See "The American Inventors of the Telegraph."—The Century, 1888.

One of the first dividing engines, designed and constructed by Jesse Ramsden, of Piccadilly, London, England, in 1774-'75, together with the apparatus, with which the screws and gear-cutters of the machine were made, was deposited by Dr. Henry Morton, president of Stevens Institute of Technology, Hoboken, New Jersey.

A sextant, which was graduated by this dividing engine in 1775, was so accurate that the English Board of Longitude, "ever ready to remunerate any successful endeavor and to promote the lunar method of determining longitude by sea," conferred a reward of £615 to Ramsden on condition that the engine should be at the service of the English instrument makers, and that he should publish an explanation of his method of making and using it. A quarto pamphlet containing this information was published in 1777, with a preface prepared by Nevil Maskeline, astronomer royal, dated Greenwich, November 28, 1776. It is interesting to note in this connection that the circles of the great theodolite, with a 36-inch telescope (still preserved at Greenwich), which was specially constructed in 1785 for the Trigonometrical Survey of Great Britain, was graduated by this engine.

The machine by which the endless screw for the dividing engine was cut, is of the greatest importance, for it is one of the earliest applications of the principle of changing the lateral speed of the tool by differential wheels in screw-cutting—the method now used in the slide-rest of the machinist's lathe. This machine, which has been developed and improved, has proved of incalculable advantage to the mechanical engineer and machinist.

### CONDITION OF THE COLLECTION.

The study series, composed mainly of graphic illustrations, has been increased by a number of photographs, prints, etc.

The card-catalogue of the collection, commenced during the year, has been finished far enough to indicate that the approximate number of specimens in the collection is 1,250, occupying 880 entries in the catalogue.

It is hoped that this catalogue will be completed during the next fiscal year.

# REPORT ON THE SECTION OF FORESTRY IN THE U. S. NATIONAL MUSEUM, 1890.

By B. E. FERNOW, *Honorary Curator.*

Progress in the development of the collections during the year has been slow for various reasons. It had been expected that the material used in the exhibit for the World's Exposition at Paris would be returned and form a desirable basis and an acceptable beginning for a systematic Museum exhibit. The bulk of the material, however, was, at the request of the Director of the Jardin des Plantes at Paris, turned over to that institution, and in this way not only the labor bestowed upon its collection was lost to the Museum, but also the time in waiting for its return.

The accessions to the forestry collections during the year have come from the Department of Agriculture. The material from the same source used in the exhibit described in my last year's report, did not receive any accession numbers, and is therefore included with the accessions of this year.*

Acc. 23584: Twenty-seven photo-lithographs, selections from the atlas of illustrations accompanying the French Government report on "Reboisement et Gazonnement des Montagnes" and the Austrian report on the same subject, exhibiting effects of forest destruction and methods of reforestation, etc.

Acc. 23585: One section of *Liriodendron Tulipifera* (Tulip Poplar), 5 feet in diameter, with historical chart of growth.

Acc. 23586: Two half-sections of *Picea Menziesii* (Sitka Spruce), 2.311 metres in diameter, gift of the Northern Pacific Railroad.

Acc. 23587: Two maps from the atlas accompanying the Tenth Census reports, volume IX, on the Forests of North America, showing distribution of forest areas and forest types.

Acc. 23796: Large map of the United States (12 by 17 feet), showing, in five shades of color, proportion of forest area in each state, and localities of greatest density of forest-growth, by markings.

Acc. 23588: Two hundred and forty colored plates, being illustrations of the forest flora of the United States, from André F. Michaux's "Sylva"; forming, together with an inscription, one of the exhibits at Paris; donated by the Massachusetts Society for the Promotion of Agriculture.

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*These accessions were not administered upon until after July 1, 1890, and therefore the accession numbers allotted to them are not comprised in the series of numbers for 1889-'90.

Acc. 23589: One hundred small label maps (6 by 6 inches) showing geographical distribution of the more important trees.

During the year five exhibits were installed. To the panel exhibiting the forestry interests of the United States, two maps from the Census work were added, showing the distribution of forest, prairie, and plain, and of the different forest types as described by Prof. C. S. Sargent. The large map (No. 23796) which is displayed, gives, at one glance, an idea of the forest conditions over the United States.

A collection of Japanese woods, 88 species, a catalogue of which, as determined by Prof. L. F. Ward, will be found in the Proceedings of the National Museum for 1881, is displayed in a new shape, being mounted in glass cases attached to the new type of large movable panels, which were originally designed by the writer. This collection is mainly interesting on account of the ingenious and artistic manner in which the botanical features are connected, by paintings, with an exhibit of the woods.

The collection of woods of the United States from the Centennial Exposition, transferred from the collections of the Department of Agriculture, is arranged in four cases, with label maps, showing distribution of more important species. This collection is quite incomplete, and the display only a temporary one, until the material for a fuller exhibit can be gathered and mounted.

The colored plates of Michaux's Sylva (No. 23588), were mounted in twenty swinging frames.

It will appear from this report that the forestry collections are still in an embryonic condition, as is the whole subject of forestry in the United States. Whatever material was found on hand—although if space and assistance were plentiful, interesting exhibits might be made of it—lacks in completeness or instructive value for one reason or another, and needs considerable additions and work before being fit for installation. To overhaul and complete this material, it has so far not been possible, for want of sufficient time from other duties on the part of the curator.

It will be desirable to devote, as soon as possible, some time and space to secure a full botanical exhibit of the arborescent flora of the United States, similar to the one exhibited at the Paris Exposition, and a more comprehensive exhibit of the most important timber trees which constitute the resource from which the lumber market is supplied. To do this properly, an assistant, conversant with botany and skillful in mounting specimens for the purpose, will be necessary.

Perhaps one of the most valuable collections on hand is that of the test pieces which served in the determination of the properties of our timbers for the Tenth Census. These should be suitably mounted in such a manner as to facilitate the study of these timbers, and I suggest that an expenditure of money for this purpose will be well directed in preserving a historical collection of valuable test pieces.

# REPORT ON THE SECTIONS OF FOODS AND TEXTILES IN THE U. S. NATIONAL MUSEUM, 1890.

By ROMYN HITCHCOCK, *Curator.*

At the beginning of the year a large collection of material of the most varied character was piled up in the utmost confusion on the east balcony, just as it had come from storage in the Armory building. The entire month of July was occupied in examining these specimens. Much of the material was condemned by a committee appointed for the purpose. Some of it was prepared for exhibition, but the greater part was placed in table cases. Four boxes, containing more than 250 specimens, were packed and sent to Sibley College, Cornell University. Other duplicate specimens were also packed and held for future exchanges. The material in the table cases has since been carefully examined, nearly every specimen having passed through my hands, and classified. By far the greater part of it has been mounted in bottles or boxes, so that it can be immediately placed on exhibition when space and cases are available. In addition to this there have been index-slips prepared, which show at a glance the location of each specimen, whether in the reserve, study, or duplicate series. There has also been prepared a list of all specimens on exhibition.

The collection of foods of the North American Indians is now permanently labeled. The textiles collection is fairly well labeled, and it is expected that in a short time all the specimens will have printed labels. The plan has been followed for some time back, of preparing labels for the printer for each new specimen mounted and exhibited. The entire exhibit of gums and resins recently installed will soon be labeled.

Many labels have been written for specimens which are not in my custody. The entire collection from the Ainos has thus been labeled, as well as some of the Japanese articles collected by me.

Mr. Luscombe has made for the Museum, from my own photographs and measurements, a model of one of the pit-dwellings or earth-houses, occupied by the Kurile Islanders now settled on the island of Shikotan, Japan. He has also made a model of an Aino house and its surroundings, including a bear-cage, sacred-hedge, and store-house. This is an excellent and faithful representation of a Yezo house.

Mr. Mills has made a most admirable lay figure of an Aino, from one of my photographs.

I have completed two reports for publication by the Museum, embodying the results of my observations in Japan during the years 1887 and 1888. These are entitled respectively, "The Ancient Pit-Dwellers of Yezo," and "The Ainos of Yezo," and are published in this volume.

A list of vegetable productions indigenous to America has been hastily prepared. It is probably incomplete, owing to the limited time at my command for its preparation, but it may possess sufficient interest to deserve notice.

In a letter written to the Assistant Secretary in charge of the Museum upon the subject I wrote as follows:

> Of products indigenous to America, perhaps the potato has been of the greatest economical importance. When America was discovered, the *Solanum tuberosum* was under cultivation in South America, from Chili to New Granada. It was carried to Ireland by Thomas Herriott, a companion of Sir W. Raleigh in his voyages, from Virginia in 1585-'86. It was introduced first into Europe by the Spaniards in 1585. The Virginia potato came from Peru or Chili. The sweet potato is also probably of American origin.
>
> The haricot bean, now cultivated in so many parts of the world, is unquestionably of American origin, as is also the Lima bean. The former has been found in ancient Peruvian graves, and more recently in prehistoric tombs in Alaska. The sugar bean also originated here.
>
> Indian corn is another valuable product for which the old world is indebted to the new. The oldest specimen of corn known was discovered by Darwin in the soil of the coast of Peru, now 85 feet above the level of the ocean.
>
> The tomato is also a Peruvian plant. Tapioca is obtained from the manioc, a shrub indigenous to Brazil and the West Indies. The flour known as cassava was in use long before the coming of the Spanish and Portuguese navigators. West India arrowroot also originated in the West Indies and tropical America, where it has long been under cultivation. The cacao tree was under cultivation when America was discovered. It was probably introduced in Central America and Yucatan from New Granada, but it was already naturalized when the Spaniards came and the custom of drinking chocolate was general. When the seeds were sent to the highlands of Mexico, they were so highly valued as to serve for money. Cocoa and chocolate are now of great commercial value. The sweet cocoa butter is highly prized in pharmacy.
>
> The common squash and pumpkin appear to be American productions. It is perhaps not desirable to extend this list of strictly American vegetable productions to include many less commonly known. There are numerous tropical fruits which are not only very delicious in the fresh condition, but also when preserved. Among these the guava is well known in the form of jelly. Two-thirds of the coffee produced in the world comes from South America, Central America, and the West Indies.
>
> Caoutchouc, or India rubber, was introduced in Europe about the beginning of the eighteenth century, but for a long time its source was unknown. Finally it was learned that it came from South America, and at present nearly half the world's supply comes from there, the other half principally from Java.
>
> Among the medicinal agents, it is only necessary to mention two—the cocoa or coca of Peru, and the cinchona bark. The former is an important and valuable tonic which has grown into great favor. The benefit which the world has derived from the alkaloids of cinchona or Peruvian bark can scarcely be overestimated. The name "cinchona" is said to be derived from the name of the wife of the Viceroy of Peru, who brought the drug from South America in 1639.
>
> In considering the contributions of this continent to the commerce of the world, it would not be fair to neglect many articles which are not peculiar to this country,

such as valuable timber, cochineal, vanilla beans, and the commoner fruits, as bananas, pineapples, oranges, etc. Among the important productions, the beautiful sea-island cotton need only be mentioned. The first bale of long staple cotton was shipped from St. Simons Island, Georgia, in 1788. Of other textiles, tropical and subtropical, America has furnished an abundance. The streets of London are daily swept with brooms made of the fiber of the piassava palm of Brazil. The pita and jeniquen, and many other fibers come from Mexico and Central America. The trade in fresh meat and hides from South America is already very large, and constantly on the increase.

The discovery of America has not only improved, increased, and cheapened the food supply of the world, but it has also, by opening new territory for settlement, relieved the countries of Europe of an increasing burden of overpopulation and thereby prevented social changes, wars and revolutions, which the increased struggle for existence would otherwise have brought about.

## ACCESSIONS.

The following are among the more important accessions received during the year:

A specimen of Germanium, a new metal discovered in 1886 by Dr. Clemens Winkler. Gift of Dr. C. Winkler, through Prof. F. W. Clarke. (Cat. No. 78072.)

Cerium. Gift of Dr. W. F. Hillebrand. (Cat. No. 78073).

Lanthanum. Gift of Dr. W. F. Hillebrand. (Cat. No. 78074.)

Didymium. Gift of Dr. W. F. Hillebrand. (Cat. No. 78075.)

These three metals from Dr. Hillebrand are of especial interest, not only because of their purity and compact form, but because they have been the subject of original researches conducted by Hillebrand and Norton in 1875. Specimens of the oxides of the same metals, interesting in the same connection, are also credited to Dr. Hillebrand.

Magnesium, purified by distillation in vacuo. Gift of W. M. Burton. (Cat. No. 78080.)

Zinc, purified by distillation in vacuo, in fine crystals. Gift of W. M. Burton. (Cat. No. 78081.)

Zinc, purified by distillation in vacuo in compact form. Gift of W. M. Burton. (Cat. No. 78082.)

The specimens of magnesium and zinc from Mr. Burton are such as were used by him in recent re-determinations of the atomic weights of these metals. They are all excellent specimens.

A most valuable collection of fibers from the Hawaiian Islands was received from Mr. Francis Gay, of Kauai, through the kind courtesy and assistance of Prof. H. C. Bolton, when he visited those islands. A list of these fibers, with the native names, is given below.

Akia, *Wickstrœmia fœtida*, var. Oahuensis Gr. Used for twine and rope.

Awapuhi, *Zingiber Zerumbet* Roscoe. Roots, stems, and leaves. Used only for scenting the native bark cloth, "Kapa."

Hau, *Paritium tiliaceum* St. Hil. Used for ropes.

Hona, one of the Urticaceæ, not determined. Used for ropes.

Mamaki, *Pipterus albidus*. One of the principal kapa plants.

Mao, *Gossypium tomentosum* Nutt. The cotton is not used for weaving. The flowers are used for dyeing kapa, and the fiber of the stem for twine.

Niu, Cocoanut. The fiber is named "Aha-niu."

Olona, *Touchardia latifolia* Gaud. The strongest Hawaiian fiber. Used for fish-lines, nets, etc.

Olena, *Curcuma longa*. Roots used for dyeing kapa.

Uki, *Gahnia Beecheyi* Mann. A grass, used to make cords for binding grass-thatched roofs.

Wauke, *Broussonetia papyrifera* Vent. Used for ropes, but particularly for making kapa.

### PRESENT STATE OF THE COLLECTIONS.

In reporting upon the present state of the collections, it must be premised that the figures given do not represent in all cases the whole number of specimens available for display, for the reason that a considerable number are stored in the Armory building. Among these should be particularly mentioned a very valuable collection of wools, the gift of Mr. George W. Bond, of Boston, which could be placed immediately on exhibition, if the necessary space could be provided. The figures given, therefore, represent only specimens which are now in the Museum, and which can be seen and examined at any time.

| | |
|---|---|
| Textile fibers and fabrics on exhibition in northeast court | 1,020 |
| Looms, spinning-wheels, and spinning and weaving machinery | 67 |
| Reserves and duplicates | 563 |
| Australian and New Zealand wools | 136 |
| Study series | 425 |

| | |
|---|---|
| Last catalogue entry, June, 1889 | 8,217 |
| Last catalogue entry, June, 1890 | 8,255 |

### PRESENT STATE OF THE COLLECTION OF FOODS.

| | |
|---|---|
| Food products on exhibition: | |
| Foods of North American Indians | 310 |
| Japanese foods | 74 |
| Japan teas | 49 |
| Foods from other sources | 223 |
| Beverages—beer, wine, etc.—including specimens showing the constituents in 1 gallon of beer, wine, etc | 71 |
| Composition of the human body, daily income and expenditure, composition of foods, etc., illustrated by specimens | 61 |
| Reserve specimens | 276 |
| Duplicate specimens | 47 |
| | 1,111 |

| | |
|---|---|
| Last catalogue entry in June, 1889 | 911 |
| Last catalogue entry in June, 1890 | 979 |

This collection does not include a number of specimens collected by me from the Ainos of Japan, which are exhibited in the Aino case, and do not appear in the food catalogue.

The specimens are distributed in different parts of the Museum, although most of them are in cases in the northeast court.

It should be stated that the collection illustrating the composition of the human body and of foods is in two cases which are too small to permit of a proper display of their contents, and the collection, which is of great public interest even as it is shown, is less attractive than it should be. There is no space in the hall for an additional case, however, and therefore no encouraging prospect for a better display in the near future. In these cases are shown the constituents of the human body and of foods, in such a manner as to illustrate the subject of nutrition and the value of food. There are several series of specimens, arranged in the following order:

(1) Chemical elements shown in the proportions by weight in which they exist in the human body. The plan and design of this exhibit will be clearly understood from one of the labels which reads as follows:

CHEMICAL ELEMENTS OF THE HUMAN BODY.

---

## CARBON.

The body of a man weighing 154 pounds would contain about 31 pounds of Carbon, which amount is shown in the form of anthracite coal.

The diamond is nearly pure carbon. Graphite (the so-called "black lead" of lead pencils), Anthracite Coal, Coke, Lamp-black, and Charcoal are impure forms of carbon.

Carbon exists in combination with other elements in the body, of which it makes about one-fifth the whole weight, and in food.

Carbon burns, *i. e.*, combines, with oxygen. In this combustion, heat and force are generated and carbonic acid gas formed. The carbon taken into the body in food is burned in this way by the oxygen of the inhaled air, yielding heat to keep the body warm, and force, muscular strength, for work. The carbonic acid is given out by the lungs and skin. Carbon thus serves as fuel for the body and is the most important fuel element.

(2) Chemical compounds in the human body, shown in their proper proportions. A specimen label reads:

CHEMICAL COMPOUNDS OF THE HUMAN BODY.

---

## NEUTRAL FATS.

The body of a man weighing 154 pounds contains about 22½ pounds of fat, the quantity shown.

Human fat consists of Stearin, Palmitin, and Olein, the so-called neutral fats, in varying proportions in different parts.

**The fats are formed in the body partly from the fatty matter of the food, and partly from the carbohydrates (sugar and starch) and the protein of the food.**

**The fats are composed of glycerine combined with a fat-acid from which the fat takes its name, as stearic acid, palmitic acid, oleic acid.**

### COMPOSITION OF NEUTRAL FATS.

| | |
|---|---|
| CARBON, | 76.5 per cent. |
| OXYGEN, | 12.0 " " |
| HYDROGEN, | 11.5 " " |

**(3) Daily income and expenditure of the body.**

## OXYGEN OF DAILY INCOME.

### 30.2 OUNCES.

The total quantity of this gas, 30.2 ounces, is 159 gallons. The quantity shown is only one-hundredth of that amount, or 0.3 of an ounce. This oxygen is obtained from the air, one-fifth of which is oxygen.

The oxygen is taken into the lungs and brought in contact with the blood, by which a portion is dissolved and distributed through the body. It is thus brought in contact with the digested food and with the tissues in various parts of the body, and combines with the carbon and hydrogen, forming carbonic acid and water, thus generating heat and muscular energy.

## CARBONIC ACID OF DAILY EXPENDITURE.

### 38.8 OUNCES.

Nearly all the carbon consumed by the body, except the small quantity that passes into urea, combines with oxygen and forms carbonic acid, which is thrown off. The total quantity of this gas, 39 ounces, is about 150 gallons. The quantity shown is only one-hundredth of that amount, 0.39 of an ounce.

### COMPOSITION OF CARBONIC ACID GAS.

| | In 100 parts. | In 38.8 ounces. |
|---|---|---|
| CARBON, | 27.3 | 10.6 |
| OXYGEN, | 72.7 | 28.2 |

Carbonic acid is a colorless gas, heavier than air. The protein, fats, and carbohydrates of the daily income contain 10.8 ounces of carbon. Of this 0.2 of an ounce goes to form urea, and the rest combines with the oxygen of the air inhaled and forms 38.8 ounces of carbonic acid, which is given off through the lungs.

(4) A day's ration.

## BEEFSTEAK OF A DAY'S RATION

### 8 OUNCES.

The principal nutrients of meat are protein and fat.

The composition of a round steak of beef, free from bone, is as follows:

| | | In 100 parts | In 8 ounces |
|---|---|---|---|
| NUTRIENTS | Protein, chiefly myosin and syntonin | 23.0 | 1.9 ounces |
| | Fats | 9.0 | 0.7 " |
| | Mineral matters | 1.3 | 0.1 " |
| WATER | | 66.7 | 5.3 " |

(5) Composition of a loaf of bread.

## PROTEIN OF A POUND OF BREAD

### 1.4 OUNCES.

The protein of bread is chiefly gluten, the proportion of which is variable. An average of several analyses showed 8.9 per cent., the proportion shown.

The protein of wheat consists of several albuminoids, the principal of which are gluten casein, gluten fibrin, gliadin, and mucedin. These together are known as gluten or vegetable albumen. They are similar to the albuminoids of meat. Gluten imparts tenacity to the dough and enables it to retain the gaseous products of fermentation with some force, thus producing a porous and light bread.

(6) Constituents of a mackerel weighing 1 pound.

## PROTEIN OF A POUND MACKEREL

### 1.6 OUNCES.

The flesh of a mackerel of average composition, weighing one pound, would contain about 1.6 ounces of protein, the quantity shown.

The protein of the flesh of fish is very similar to that of the flesh of domestic animals used for food. It is found mostly in the muscles and consists of several compounds. The principal of these compounds is called myosin, the basis of muscle of man and animals. The protein compounds, sometimes called " flesh formers " or " muscle substance," are physiologically the most important and pecuniarily the most expensive ingredients of food.

(7) Composition of milk.

## A QUART OF MILK.

### ALBUMINOIDS OR PROTEIN COMPOUNDS. ALBUMEN, 0.2 OUNCES.

The albumen, which is of one of the albuminoid or protein compounds of milk, is nearly or quite identical in chemical composition with the albumen (white) of egg and the albumen of blood, muscle, etc.

The proportions of albumen and other albuminoids in milk are stated under casein. A quart of cow's milk, of average composition, would contain not far from 0.2 of an ounce of albumen, the quantity shown.

Four colored charts showing the composition and nutritive value of vegetable and animal foods have been carefully prepared. These are now in the cases.

### PRESENT STATE OF THE CHEMICAL COLLECTIONS.

| Specimens on exhibition: | |
|---|---|
| Chemical elements | 97 |
| Specimens illustrating chemical manufactures | 69 |
| Oils | 201 |
| Gums and resins | 90 |

### RESERVES AND DUPLICATES.

| | |
|---|---|
| Chemical compounds (inorganic) | 307 |
| Chemical compounds (organic) | 73 |
| Specimens illustrating chemical manufactures | 149 |
| Dyes, paints, etc | 197 |
| Oils | 67 |
| Gums and resins | 59 |

An interesting exhibit of the chemical elements has been prepared, showing the elements arranged in accordance with their atomic weights and valency, as first carried out by Lothar Mayer and V. Mindelejeff. The plan of arrangement is as follows:

*Arrangement of the Chemical Elements.*

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Valency....... | H. 1<br>Hydrogen. | | | | | | | | | | |
| Valency 1...... | Li. 7<br>Lithium. | Na. 23<br>Sodium. | K. 39<br>Potassium. | Cu. 63.3<br>Copper. | Rb. 85.5<br>Rubidium. | Ag. 108<br>Silver. | Cs. 133<br>Cæsium. | | | Au. 197<br>Gold. | |
| Valency 2...... | Gl. 9<br>Glucinum. | Mg. 24<br>Magnesium. | Ca. 40<br>Calcium. | Zn. 65<br>Zinc. | Sr. 87.5<br>Strontium. | Cd. 112<br>Cadmium. | Ba. 137<br>Barium. | | | Hg. 200<br>Mercury. | |
| Valency 3...... | Bo. 11<br>Boron. | Al. 27<br>Aluminum. | Sc. 44<br>Scandium. | Ga. 69<br>Gallium. | Yt. 89<br>Yttrium. | In. 113.5<br>Indium. | La. 138<br>Lanthanum. | | Yb. 173<br>Ytterbium. | Tl. 204<br>Thallium. | |
| Valency 4...... | C. 12<br>Carbon. | Si. 28<br>Silicon. | Ti. 48<br>Titanium. | Ge. 72<br>Germanium. | Zr. 90<br>Zirconium. | Sn. 118<br>Tin. | Ce. 141<br>Cerium. | | Tr. 148.5<br>Terbium. | Pb. 207<br>Lead. | Th. 232<br>Thorium. |
| Valency 3–5.... | N. 14.<br>Nitrogen. | P. 31<br>Phosphorus. | V. 51<br>Vanadium. | As. 75<br>Arsenic. | Cb. 94<br>Columbium. | Sb. 120<br>Antimony. | D. 145<br>Didymium. | Er. 166<br>Erbium. | Ta. 182.<br>Tantalum. | Bi. 208<br>Bismuth. | |
| Valency 2–6.... | O. 16<br>Oxygen. | S. 32<br>Sulphur. | Cr. 52<br>Chromium. | Se. 79<br>Selenium. | Mo. 96<br>Molybdenum. | Te. 125<br>Tellurium. | Sm.<br>Samarium. | | W. 184<br>Tungsten. | | U. 239<br>Uranium. |
| Valency 1–7.... | F. 19<br>Fluorine. | Cl. 35.5<br>Chlorine. | Mn. 55<br>Manganese. | Br. 80<br>Bromine. | Ru. 101.4<br>Ruthenium. | I. 127<br>Iodine. | | | Os. . 191.5<br>Osmium. | | |
| Valency 2–8.... | Fe. 56<br>Iron. | Co. 59<br>Cobalt. | Ni. 58<br>Nickel. | | Rh. 104<br>Rhodium. | Pd. 106<br>Palladium. | | Ir. 193<br>Iridium. | Pt. 196<br>Platinum. | | |

The object of this arrangement is to indicate gaps in the series of known elements which are likely to be filled in future by the discovery of new elements, the properties of which may be foretold with more or less certainty from their position in the series.

The existence of the three metals, scandium, gallium, and germanium, was thus predicted before they were discovered.

The position of some of the elements in the table is not yet well established. The metals in the last row are provisionally placed in groups by themselves.

The specimens here brought together under the head of chemical collections are catalogued in different registers. The last entries under the respective heads are—

*Chemicals.*

| | |
|---|---|
| June, 1889 | 78067 |
| June, 1890 | 78082 |

*Paints and Dyes.*

| | |
|---|---|
| June, 1889 | 9041 |
| June, 1890 | 9041 |

*Oils, Gums, Resins, etc.*

| | |
|---|---|
| June, 1889 | 2713 |
| June, 1890 | 2740 |

A specimen label will indicate the general character of all. Such labels are usually attached to bottles, and as these are never large, it is necessary to condense the text of the labels as much as possible.

**GERMANIUM, Ge.**—Valency 4; atomic weight 72; specific gravity 5.469 at 20°.4 C.

A grayish-white, lustrous, crystalline, brittle metal, easily pulverized, discovered by C. Winkler in 1886, in argyrodite, a mineral found near Freiberg, of which it constitutes about 7 per cent. Unchanged in air, soluble in aqua regia. Fuses readily. 78,072.

Gift of Dr. C. WINKLER through Prof. F. W. CLARKE.

Specimen prepared by C. WINKLER.

The existence of this element was predicted from the atomic relations of the elements as shown by Mendelejeff's table.

A system of classification for organic and inorganic compounds will soon be necessary, and will be prepared as soon as time and opportunity may permit.

A preliminary plan for an exhibit at the World's Columbian Exposition at Chicago, illustrating chemistry and the chemical industries, has been prepared.

All the collections are now in excellent order. A large and valuable industrial exhibit could be very quickly made if floor-space and cases could be provided. Many of the specimens are already mounted and stored in drawers, ready to be placed in cases and labeled.

# REPORT ON THE SECTION OF MATERIA MEDICA IN THE U. S. NATIONAL MUSEUM, 1890.

By JAMES M. FLINT, U. S. NAVY, *Honorary Curator.*

During the past year the labors of the curator, with such clerical assistance as may have been available or necessary, have been devoted to the identification, arrangement, distribution, illustration, and description of the individual specimens which make up the large mass of material already in hand; to the classification and installation of new material; to the care and convenient arrangement of duplicate and reserve series; and to the consideration of such questions of identity or uses of drugs, as have been referred, from time to time, to this Section.

The principal accessions have been: A collection (about 30 specimens) of East India drugs, received in exchange from the Royal Botanical Gardens, Kew, England, and about 80 specimens of miscellaneous medicinal substances contributed by Messrs. W. H. Schieffelin & Co., of New York, to fill vacancies in existing series. Both accessions have been installed and labeled.

The most important routine work has been the preparation of descriptive labels, which work has been systematically and persistently carried on during the year. Each label, in its preparation, involves the study of the specimen, the comparison of its physical characters with those laid down by the authorities, the determination of its sources, (geographical, botanical, etc.), and of its supposed medicinal properties and uses. The effort is made to select the most important and interesting facts that can be presented in the few lines appropriate to a museum label, avoiding on the one hand that meagerness which gives the inquiring visitor nothing but a name, and, on the other, that fullness of detail which discourages by its length, or confuses by its technical precision.

Of these labels there have been prepared, printed, and attached to the specimens 2,312, distributed as follows:

| | |
|---|---|
| General labels | 4 |
| Class and order labels | 103 |
| Generic labels | 31 |
| Specific labels | 1,902 |
| For botanical figures | 218 |
| For animal figures | 17 |
| For micrographic figures | 37 |

Manuscript for 284 additional labels is nearly ready.

The present state of the collection is quite satisfactory to the curator. Most of the specimens are in good condition, and liable only to unavoidable deterioration from age, exposure to light, and changes of temperature. It is to be hoped that a substitute for the present cylindrical bottle may be devised for exhibition purposes, whereby the specimens may be shown behind plane instead of curved surfaces of glass. There are now on exhibition 3,213 specimens of drugs, classified as follows:

| | |
|---|---|
| Medicinal forms | 116 |
| Animal products | 112 |
| Officinal vegetable products | 1,237 |
| Chemical and inorganic products | 196 |
| Mineral waters and their constituents | 95 |
| Indigenous vegetable products | 162 |
| Medicines of North American Indians | 116 |
| Mexican drugs | 43 |
| West Indian drugs | 77 |
| South American drugs | 45 |
| Drugs of India | 325 |
| Chinese medicines | 469 |
| Japanese medicines | 115 |
| Corean medicines | 100 |
| Miscellaneous | 7 |
| | 3,213 |

These specimens are illustrated by 235 colored plates and 37 micrographs, displayed in the cases, and also 426 by colored plates and 1 micrograph, mounted in swinging frames, supported upon pillars standing at the entrances to the alcoves.

In the reserve series there are:

| | |
|---|---|
| Cinchona barks | 99 |
| Crushed and powdered drugs | 204 |
| Fluid extracts | 200 |
| Pills and granules | 70 |
| Oils | 36 |
| Chemical products | 33 |
| South American drugs | 108 |
| Corean medicines | 107 |
| Miscellaneous | 346 |
| Total | 1,203 |

The miscellaneous drugs include the rare articles, many of them unidentified or bearing only a vernacular name, which are withheld from exhibition until further information can be obtained about them.

In the duplicate series are 800 specimens, mostly inclosed in pasteboard boxes, and arranged in drawers conveniently accessible.

| | |
|---|---|
| Exhibition series: | |
| Specimens | 3,213 |
| Illustrations | 699 |
| Reserve series | 1,203 |
| Duplicate series | 800 |
| Total | 5,915 |

A card-catalogue of the collection, showing the present location of every specimen, has been prepared. This catalogue needs revision and extension by cross references.

The number of the last catalogue entry in June, 1889, was 141,877; in June, 1890, 142,056.

# REPORT ON THE DEPARTMENT OF PREHISTORIC ANTHROPOLOGY IN THE U. S. NATIONAL MUSEUM, 1890.

By Thomas Wilson, *Curator.*

On July 8, 1889, I was directed to proceed to Europe, especially to Paris, in company with Prof. Otis T. Mason, to visit and report upon the anthropological display at the French Exposition, to represent the Smithsonian Institution at the International Congresses of Hygiene, of Criminal Anthropology, and of Anthropology and Prehistoric Archæology, and the French Association for the Advancement of Science, to be held there during the month of August. I was also directed to visit and report on certain archæological museums.

## INTERNATIONAL CONGRESSES, PARIS, 1889.

The number and scope of congresses, held in Paris during the season of the Exposition, the amount of time consumed, and the work accomplished, may be made manifest by the following list:

*List of International Congresses held at Paris during the Exposition of* 1889.

Of Life-saving, June 12–15.
Physical Exercise in Education, June 15–22.
Of Architects, June 17–22.
The Society of Literateurs, July 17–27.
Of Peace, June 23–30.
Protection of Monuments and Works of Art, June 24–29.
Habitations, June 26–28.
Of Bakers, June 28–July 2.
Intervention of Government with contracts of Workingmen, July 1–4.
Of Agriculture, July 4–11.
Technical Education in Commerce and Industry, July 8–12.
Workingmen's Clubs, July 11–13.
Charitable Works and Institutions of Females, July 12–18.
For the Participation in certain Benefits, July 16–19.
Bibliography of Mathematical Science, July 16–26.
Works of Assistance in Time of War, (Red Cross?), July 17–20.
Utilization of Fluvial Waters, July 22–27.
Of the Rights of Property in Artistic Work, July 25–31.
Public Assistance (charity), July 28–Aug. 4.
Alcoholism (to study its questions), July 29–31.
Popular Traditions, July 29–Aug. 1.
Chemistry, July 29–Aug. 3.
To Study Colonial Questions, July 30–Aug. 3.
Of Aëronauts, July 31–Aug. 3.
Of Pigeon Fanciers, July 31–Aug. 3.
Of Therapeutics, Aug. 1–5.
Of Industrial Property, Aug. 3–12.
Hygiene and Demography, Aug. 4–11.

Of Zoölogy, Aug. 5–10.
Of Physiologic Psychology, Aug. 5–10.
Dermatology and Syphiliography, Aug. 5–10.
Superior and Secondary Education, Aug. 5–10.
Mental Maladies and their Cure, Aug. 5–10.
For the Amelioration of the Blind, Aug. 5–8.
The Sciences of Geography, Aug. 6–12.
Of Photography, Aug. 6–17.
For the Transmission of Landed Property, Aug. 8–14.
Of Criminal Anthropology, Aug. 10–17.
Of Stenography, Aug. 11–18.
Of Primary Instruction, Aug. 11–19.
Of Societies *par actions*, Aug. 12–19.
Intervention of Government in Emigration and Immigration, Aug. 12–15.
Of Horticulture, Aug. 19–21.
Of Anthropology and Prehistoric Archæology, Aug. 19–26.
Of Medical Jurisprudence, Aug. 19–24.
Of Flour and Grain, Aug. 20–22.
Homeopathy, Aug. 21–23.
Astronomical Photography, Aug. 22–23
Of Electricians, Aug. 24–31.
Of Firemen, Aug. 27–28.
Dental, Sept. 1–7.
Of Statistics, Sept. 2–6.
Institutions of *Prevoyance*, Sept. 2–7.
Of Mines and Metallurgy, Sept. 2–11.
Of Chronometry, Sept. 7–14.
Coöperative Societies for the Purchase of Food and Drink, Sept. 8–12.
Of Veterinary Medicine, Sept. 19–24.
To Study the Processes of Construction, Sept. 9–14.
To Study the Accidents to Workmen, Sept. 9–14.
Monetary, Sept. 11–14.
Of Otology and Laryngology, Sept. 16–21.
Applied Mechanics, Sept. 16–21.
Meteorology, Sept. 19–25.
Maritime Works, Sept. 20–25.
Commerce and Industry, Sept. 22–28.
Sabbath-day Rest, Sept. 26–27.
Ethnographical Sciences, Sept. 30–Oct. 10.
Hydrology and Climatology, Oct. 3–10.
Total number, 69.

Such was the list of organized International Congresses as published before the opening of the Exposition. There were others organized after this list was printed; and during the continuance of the Exposition no less than one hundred and twenty congresses, principally international, though similar to the foregoing, were held at Paris.

The congresses to which I was accredited, and in most of which Prof. Otis T. Mason joined, held their sessions as follows:

Hygiene and Demography, opening session on Sunday, August 4, at 3 o'clock, to continue until the 11th of the same month.

Criminal Anthropology, opening session on Saturday, August 10, at 2 o'clock, at the Palace of Trocadéro, to continue until the 17th, at the School of Medicine.

Anthropology and Prehistoric Archæology, opening session on Monday, August 19, to continue until August 26, at the College of France.

The French Association for the Advancement of Science held its session from the 8th to the 16th of August at the School of Bridges and Roads, No. 28, rue St. Péres. Two sessions per day were held, commencing at 9 a. m. and 2 p. m.

I presented papers, prepared by myself, to the various congresses, as follows:

Criminal Anthropology, 8 pages: (1) The statistics of crime in the United States.

Anthropology and Prehistoric archæology: (1) The gravels of the

Delaware River at Trenton, New Jersey, wherein Dr. Abbott had found paleolithic implements, 20 pages; (2) The stone age in North America divided into the paleolithic and neolithic periods, as manifested by specimens in the U. S. National Museum (130 pages, 100 figures).

Association Française: (1) The value of Niagara Falls as a chronometer of antiquity (12 pages, 5 figures); (2) Instruments of hard stone in America (14 pages).

Since my return I have completed a report upon Prehistoric Anthropology at the Paris Exposition, 1889, and upon the International Congresses of Anthropology and Prehistoric Archæology; Criminal Anthropology; Hygiene and Demography.

## IMPORTANT ACCESSIONS.

From Mr. H. de Morgan, New York, New York, was purchased a collection of objects from prehistoric graves at or near Allah-Verdi, Armenia, including bronze necklaces, bracelets, buttons, pins (plain and ornamented), pendant with chain attached, iron spear-heads and knives, sharpening-stones, shell beads, pottery vessels (bottles, urns, and plates), a human skull and fragments of human bones; 105 specimens. These objects were discovered and excavated by Mr. de Morgan in the summer of 1888, and belong to the iron age in Armenia. (Accs. 22244 and 22264.)

J. P. Monroe, Ringgold, Montgomery County, Tennessee, sent a brass chain of peculiar manufacture from a mound in Montgomery County, Tennessee. The chain was made of pieces of brass wire and tubes alternating in the following manner: First, the wire, cut to the required length, was enlarged at each end; second, a section of the tube was then, by hammering or pressure, closed around the enlargement of the wire at one end—not enough to prevent motion inside the tube, but sufficient to stop its removal. Another wire, being inserted in the opposite open end of the tube, was made secure in the same way. This process was continued until the chain was of the required length. (Acc. 22697.)

From Mr. Monroe's letter of transmittal I quote the following:

> The mound in which the chain was found is situated in the northern part of Montgomery County, 16 miles from Clarksville. It is in a large body of timber and would be seldom noticed. Its shape is oval and of the following dimensions: 60 by 46 feet at the base, 16 feet diameter at the top, and 10 feet high.
>
> When first built the mound was higher and not so broad at the base, the rains and snows of centuries having washed the dirt from the top. Of course this proceeded very slowly, as the sides are covered with trees and undergrowth, the oak trees being from 1 foot to 2 feet 6 inches in diameter. The graves were arranged in the regulation way, *i. e.*, flat rocks set upon edge, forming a box, in which the body was laid, and other rocks (slabs) placed across the top. These were near the surface and disarranged, showing evidently that the mound had been dug into before, and also accounts for the fact that no other specimens were found associated with the chain, except some broken pieces of pottery. The chain being very small, was overlooked by the hunters.

Mrs. J. G. Bruff, Washington, District of Columbia, sent a large collection, principally from the District of Columbia and vicinity, embracing paleolithic implements, rude notched axes, hammer-stones, pestles, arrow and spear-points, scrapers, polished stone hatchets, drilled ceremonial objects, discoidal stones, potstone vessels, etc.; 1,487 specimens. (Acc. 22308.)

This collection, which represents the archæology of the District fairly well, is the result of many years' work on the part of Mr. Bruff, and the specimens are labeled with great accuracy as to locailty, date of find, and other facts which might be of interest to the student.

The curator deposited a collection of archæological specimens obtained by him during his visit to the International Exposition at Paris in 1889. The greater portion consists of palæolithic implements of the Chelleèn type, although a number of flint-points and flakes, and a mass of drift-deposit containing flint implements, etc., were obtained; also four jars in which are exhibited the sand or gravel forming the different layers of the river drift at Chelles, these last showing a difference in color and fineness according to depth. In addition, a number of palæolithic implements, surface-finds, from St. Acheul, Poitou, and Coussay, France, and one each from Highfield, Ightham, Buley, and the "Stone Pits," Kent, England (B. Harrison). The neolithic objects received include flint cores and flakes—some very large—from the workshops at Grand Pressigny and Posay, France, and from the Grotte de Chaleur, Belgium. Also obsidian cores from the Ile de Milo, Greece, and fragments of pottery from Russia. A bronze hatchet and a piece of copper (part of an implement) from Peru, complete the list; 99 specimens. (Acc. 22523.)

W. E. Meyer, Carthage, Tennessee, gave a collection containing fragments of human bones, shell beads, fragments of shell, bones and teeth of small animals, pieces of stalagmitic formation (?), and flint chips from caves in the vicinity of Carthage. (Acc. 22771.) In his letter of transmittal he says:

> The human bones were found in a small cave on a river bluff, the entrance to which has been nearly closed by rock falling from above. They were scattered all through the dirt floor of the cavern and had no regular arrangement, neither were they found in such positions as to indicate burial (at least so it appeared to me). At the farthest extremity of the cave there is an opening—closed now—which communicated with the top of the bluff. I do not think all of the bones were washed in, for we found a few in such positions that it would seem impossible. The animal bones came from another cavern, also on the face of a river bluff, and in the dirt floor at the depth indicated.

From Messrs. Bangs & Co. (739 and 741 Broadway, New York, New York) the following objects were purchased for the Museum:* Arrow and spear-points, scrapers, knives, perforators, large spade-like implements (chipped), flint hatchets—some with ground cutting edge—polished hatchets, grooved axes of hematite, pierced tablets, and boat-shaped articles, pendants, drilled ceremonial objects, stone tubes and pipes, hematite mullers, and discoidal stones; 171 specimens in all. The localities where found are indicated in all cases. (Acc. 22813.)

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* This accession is part of a collection placed on sale by Mr. Norman Spang.

S. V. Proudfit, Falls Church, Virginia, deposited a large collection (2,345 specimens) from the District of Columbia and its environs, consisting of arrow and spear-points, knives, rude implements (palæolithic type), scrapers, perforators, hammer-stones, pitted stones, polished hatchets, grooved axes, rude notched implements, mortars, pestles, pierced tablets, ceremonial objects, fragments of potstone vessels, and fragments of pottery. This collection is the result of years of work in the field, and is a valuable addition to the Museum, for it represents the archæology of the District of Columbia in a complete manner. (Acc. 22631).

Peabody Museum, Cambridge, Massachusetts, through Prof. F. W. Putnam, sent in exchange a collection from the ancient cemetery and ashpits at Madisonville, Ohio, embracing stone hatchets, hammer and sharpening-stones, small rude implements, scrapers, perforators, and arrow-points of flint and jasper, clay vessels, and fragments of pottery. Also halves of the bone-scrapers peculiar to this cemetery, worked pieces of antler (chisels and points of weapons), cylindrical pieces of antler, burnt bones, piece of bone ornamented with incised lines, bird bone showing method of cutting off a bead, bone beads and points, bone splinters—long, thin, and worked to a point at each end—fish spines probably used as awls, bones and teeth of animals, burnt corn, and a sample of ashes from one of the pits; 324 specimens. (Acc. 23111).

Dr. Hilborn T. Cresson, No. 224 South Broad street, Philadelphia, Pennsylvania, deposited palæolithic implements found below the surface in undisturbed gravel at the depths indicated: quartzite, Upland, Chester County, Pennsylvania, 8 feet; quartzite, Upland, Chester County, Pennsylvania, 11 feet; quartzite, Gray's Ferry, Baltimore and Ohio Railroad cut, 4 feet; quartzite, Gray's Ferry, Baltimore and Ohio Railroad cut, 6 feet; quartzite, Gray's Ferry, Baltimore and Ohio Railroad cut, 7½ feet; quartzite, Naaman's Creek cut, 5¾ feet; quartzite, near Darley's Bridge cut, 3½ feet; quartzite, Peat Layer, near Darley's Bridge, dredged, 10 feet; quartzite, Naaman's Creek, near Richmond Brickyard, 14 feet; quartzite, near Wilmington, Delaware, 8 feet; quartzite, near Wilmington, Delaware, 12 feet; white quartz, talus, at base of cut, Upland, Chester County, Pennsylvania; argillite, talus, at base of cut, Carpenter's Station, near Darley's Bridge, Baltimore and Ohio Railroad; quartzite, surface, Piney Branch, District of Columbia, 14 specimens in all. (Acc. 23198.) These implements are only deposited as a loan by Dr. Cresson, though I have no doubt he will permit them to remain indefinitely. Although few in number and their money-value not great, I can scarcely overestimate their scientific value. They are the first implements found in undisturbed clay and gravel, independent of any glacial action, and I see no reason why they are not preglacial. They correspond in appearance and industry with those which I have been already gathering on the surface throughout the United States, and I can only conclude that they belong to the same epoch.

L. H. Jammes, Realmont, Tarn, southwestern France, sent a collection of prehistoric implements, ornaments, etc., from Cambodia, Indo-China. This accession includes stone hatchets (five of which are *a talon*, a type peculiar to Indo-China), gouges, sling-stones, pierced disks, and bracelets of stone, beads of bone and shell, a bone fish-hook, a bone arrow-point, a harpoon, ear ornaments of pottery, a clay vessel, fragments of pottery, lower jaw and part of human skull, pieces of a large shell—worked—and a mass of shell formation containing fragments of worked bone; 176 specimens. (Acc. 23024.)

Duplicate specimens have been sent in exchange as follows:

To Edward Lovett, West Burton House, Outram Road, Croydon, England (97 specimens).

To Prof. Henry Giglioli, director of the Zoölogical Museum, Royal University, Florence, Italy (12 specimens).

To Frederic Shounard, Yonkers, New York (6 specimens).

To Mr. Henry Balfour, Anthropological Department, Oxford University, England (7 specimens).

To Dr. Paulo Mantegazza, professor of anthropology, Florence, Italy (55 specimens).

The routine work and the preparation of the exhibition and study-series has been carried on during the past fiscal year upon the same basis and with the same organization as in past years, and as I found it when I came into the Museum. All specimens received are entered in the catalogue, giving all known information concerning them, their discovery, locality, association, etc. A catalogue number is given to every specimen and is painted upon the specimen itself. If there are a number of specimens of not great importance, which correspond in all general characteristics, they may be all given the same number. In former years nothing but the number was required; now the State is added, and if the object is a gift, the name of the donor.

The record taken from the monthly reports of this office shows that there have been 431 letters written to correspondents. The letters and reports written to officers in the Museum is not included in this number. Since February, when a record of such matters was first kept, 2,430 pages of type writing have been written.

The general character of the work in this department must necessarily be much the same one year with another. There is the same reception of specimens, their entering, numbering, marking, and display. This year has, however, seen much work done in addition to this. Although not perfected, we have partially carried out the new scheme of organization which was advised by Dr. Rau in his last report, and which has been mentioned in all my reports since: *i. e.*, the arrangement of specimens according to their geographical location. The system adopted in the early history of the Museum was to note only the State from which the specimen came. The locality within the State was not usually given. Therefore we find ourselves hampered in making the geographical distribution more minute than by States, however desirable this may be. We may be able to make the distribution more in detail which, while it will entail much work and require considerable time, will be correspondingly valuable when completed. It is my present intention to pursue this scheme of localized distribution as far as possible, so as to include what we may suppose to have been the territories occupied by one prehistoric tribe or people and to make the boundaries such as were established by nature and what we may suppose divided the tribes. The intended units of display will therefore include the valleys of rivers, both sides of the river being equally represented. For example, the Susquehanna River should be represented as a unit independently of the boundary line of Maryland and Pennsylvania which cross it; the same with the Delaware River independent of the boundary line between Pennsylvania and Delaware.

The dividing line between these units might be such natural obstacles as the Allegheny Mountains, the Chesapeake Bay, etc., which may be supposed to have served as frontiers of greater or less obstruction, and so to have divided the prehistoric tribes or peoples. But this is a scheme in the indefinite future, and is liable to modification.

### EXHIBITION AND STUDY SERIES.

The exhibition series is arranged in cases with a view to showing the industries of prehistoric man, divided according to epochs and geographic location. The subject of the division of museums according to the object desired and the people to be benefited, has been presented and argued many times. An exhibition series should be provided for the average visitor who has but a few minutes to devote to the display; while a study series should be for the student who desires better instruction in the scientific aspect of the case. This division has never been made in my department until the present fiscal year. I have always recognized its benefit, even its necessity, and therefore determined that, laying aside all other work, I would arrange a series of specimens as a museum for exhibition and public instruction. This I have called a synoptical case or series of cases. I have made use of four double sloping-top cases, which placed end to end make a continuous series across the hall. On the side nearest the door and first of approach, are arranged specimens from other countries than America, upon the farther side specimens from America. The European specimens are divided according to their respective ages; paleolithic, neolithic, and bronze. Each of these ages is again divided into epochs, and the epochs are divided into countries and according to localities. I do not burden this report with detailed descriptions of these subdivisions. Suffice it to say that nearly every country in Europe is represented, as is every epoch of prehistoric man in that country; and that specimens of nearly every standard implement or object tending to show the civilization of the prehistoric man of that country and epoch, are here displayed. The same thing is true with regard to the other side, which represents the United States. I have not trenched upon any of the disputed questions concerning our prehistoric races, and have only sought to divide the implements and objects according to function and treating the United States as a whole. I have attempted in this case a classification of the stone arrow or spear-heads, or knives. I have sought to make but few classes with the lines deeply drawn, so as to be easily recognized and the divisions well understood.

## CLASSIFICATION OF ARROW-HEADS, OR SPEAR-HEADS, OR KNIVES.

### LEAF-SHAPED.

*Sub-class A.*—Thin and finely chipped implements of the form of a laurel leaf, elliptical and pointed at both ends. They correspond substantially with the French Solutreen type of the Paleolithic period of the Stone Age.

*Sub-class B.*—These may be thicker and ruder than Sub-class A. Some are more oval, and the bases are not pointed, but are either straight or convex. This class includes the leaf-shaped argillite implements found by Dr. Abbott in the Delaware gravels at Trenton, New Jersey.

*Sub-class C.*—Long, thin blades, with nearly straight edges, more like a dagger or poniard. The base may be either convex, straight, or concave. Many of them show traces of attachment to a handle by means of bitumen or gum. They are peculiar to the Pacific Slope.

### TRIANGULAR.

This class includes all forms approaching a triangle, whether the bases or edges be convex, straight, or concave. They are without stems, and, consequently, without shoulders, but in some specimens the concavity of the base produces barbs.

### STEMMED.

This class includes all varieties of stems, whether straight, pointed, or expanding, and all varieties of bases and edges, whether convex, straight, or concave.

*Sub-class A*, lozenge-shaped.

*Sub-class B*, shouldered, but not barbed.

*Sub class C*, shouldered and barbed.*

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* Nearly all of these convex bases are smooth, as though they had been worn. The purpose or cause of this is unknown.

### PECULIAR FORMS.

These have such peculiarities as distinguish them from all other classes, but by reason of their restricted number or locality can scarcely form a class by themselves.

*Sub-class A*, beveled edges. The bevel is almost always in one direction.

*Sub-class B*, serrated edges.

*Sub-class C*, bifurcated stems. (Other sub-classes will be added.)

The present state of the collection is shown in the following detailed statement:

*Number of specimens in this Department.*

| | | |
|---|---|---|
| Brought forward from last year | | 115,651 |
| Received during the year ending June 30, 1890 | 7,205 | |
| Specimens sent in exchange | 177 | |
| | | 7,028 |
| Total | | 122,679 |
| Number of catalogue entries made during the year | | 1,483 |

# REPORT OF THE DEPARTMENT OF MAMMALS IN THE U. S. NATIONAL MUSEUM, 1890.

By FREDERICK W. TRUE, *Curator.*

The accessions of the year have been of more than ordinary interest. Among exotic mammals, the accession which should be mentioned first is a collection of about ninety skins from Mt. Kilima-Njaro, East Africa, made and presented by Dr. W. L. Abbott. The series comprises numerous antelopes, including an undescribed species, (*Cephalophus spadix* True), wart-hogs, rhinoceros heads, buffalo heads, and skins of various smaller forms, such as squirrels, coneys, and ground rats. The naturalists attached to the United States Eclipse Expedition to Angola, Africa, procured two fine skins of the Bush-buck, *Tragelaphus gratus* (?), and some smaller mammals. The Marquis Doria forwarded to the Museum a specimen of the exceedingly rare African rodent, *Lophiomys imhausii*, and a hundred bats, in alcohol, for which an equivalent in North American bats is to be returned. The trustees of the British Museum presented 13 bats in alcohol. A small collection of beautifully prepared skins of the small mammals of Hungary was presented by M. Louis Molnar. A skin of an adult male lion, and a young moose, were received from the American Museum of Natural History, New York, in exchange for other specimens. A skin of the Yaguarundi cat was purchased from E. Gerrard, London.

The group of Proboscis Monkeys, *Nasalis larvatus*, ordered from Mr. C. F. Adams, of Champaign, Illinois, was received during the year. Further reference to this group will be found on the next page. A number of mounted mammals were purchased from É. Deyrolle, Paris.

The American Museum of Natural History, New York, presented a bust of the chimpanzee "Crowley," which formerly lived in the Central Park menagerie.

The most notable North American mammals received during the year were: four Bighorn Sheep, *Ovis canadensis*, from Wyoming, presented by Mr. W. T. Hornaday; and four Mountain Goats, *Mazama montana*, obtained by Mr. G. B. Grinnell in British Columbia, These skins will be made the basis of two groups. Mr. E. E. Thompson presented a collection of small mammals of Ontario, Canada, including a series of skins of a black variety of the Gray Squirrel. Dr. Stejneger collected a considerable number of small mammals in Arizona, and Mr. C. H. Townsend in the San Pedro Mountains, Lower California. Mr. L. Belding presented a number of small mammals from the vicinity of Lake Tahoe, Nevada. Similar material from California, Texas, and Colorado was purchased from Mr. C. K. Worthen. A semi-albino Skunk, *Mephitis putorius*, was purchased from Mr. J. C. Strong, of Morantown, Kansas.

A Harbor Seal, *Phoca vitulina*, was presented by Capt. R. C. Joynes, keeper of the Hog Island life-saving station, Virginia. At the request of the Museum, Capt. A. H. Myers, keeper of the Quoddy Head Life-Saving Station, Maine, procured excellent photographs of a little Piked Whale, *Balœnoptera rostrata*, which had been stranded in the vicinity.

The appearance of the exhibition hall was considerably altered by the introduction of three large cases, intended for the reception of groups. Three groups were installed during the year, namely, those of the moose, musk-oxen, and proboscis monkeys. The latter, however, was placed temporarily in the case intended for the reception of the Prong-horn Antelope group, this group having been withdrawn for alterations. The group of moose is the largest, and, everything considered, the most striking group that has yet been constructed, and the case containing it is the largest floor case in the Museum. The dimensions of the case are as follows: Length, 16½ feet; breadth, 12½ feet; height, 11 feet. Each side has two sheets of glass only. The group comprises two adult males, an adult female, and a young calf. The scene represented is a Canadian forest in autumn. The Musk-ox group comprises three individuals, an adult male, an adult female, and a young male. These specimens have been in the Museum for many years, but, on account of their rarity, were considered deserving of a more prominent place than they have hitherto occupied. The group of proboscis monkeys comprises individuals of different ages and both sexes. The specimens were obtained from and mounted by Mr. C. F. Adams, who visited Borneo a few years ago. The group of Prong-horn Antelopes, which was exhibited last year, has been, as already stated, withdrawn temporarily, for alterations and additions, but will eventually be placed in the special case now occupied by the proboscis monkeys. Besides the groups, a considerable number of single specimens were added to the exhibition series during the year. These are as follows:

White-handed Gibbon, *Hylobates lar*.
Himalayan Langur, *Semnopithecus schistaceus*.
Crested monkey, *Semnopithecus cristatus*.
Black-crested monkey, *Semnopithecus melalophus*.
Dusky monkey, *Semnopithecus obscurus*.
Moor monkey, *Semnopithecus maurus*.
Ursine colobus, *Colobus ursinus*.
Rusty colobus, *Colobus ferrugineus*.
Kirk's colobus, *Colobus kirkii*.
Black monkey, *Cynopithecus niger*.
White-nosed monkey, *Cercopithecus petaurista*.
Ashy-black macaque, *Macacus ocreatus*.
Capuchin monkey, *Cebus capucinus*.
Spider monkey, *Ateles bartletti*.
Spider monkey, *Ateles belzebuth*.
Couxio monkey, *Pithecia chiropotes*.
Monk monkey, *Pithecia monachus* (2).
Red-faced Ouakari monkey, *Brachyurus rubicundus*.
Mantled howler monkey, *Mycetes palliatus*.
Black howler monkey, *Mycetes niger*.

Copper-colored monkey, *Callithrix cuprea.*
Illiger's marmoset, *Midas illigeri* (2).
White-footed marmoset, *Hapale leucopus.*
Common marmoset, *Hapale jacchus.*
Least marmoset, *Hapale pygmæa.*
Ocelot, *Felis pardalis.*
Malay bear, *Ursus malayanus.*
Musk deer, *Moschus moschiferus.*
Wart hog, *Phacochoerus æthiopicus.*
Capybara, *Hydrochoerus capybara.*
Yellow-footed pouched mouse, *Phascogale flavipes.*
Spotted cuscus, *Phalanger maculatus.*
Black-tailed wallaby, *Macropus ualabatus.*

Considerable confusion existed in the exhibition hall during the installation of the moose group, but a temporary re-arrangement of cases was made as soon as practicable. The east wall-case was painted during the winter, and all the specimens therein have been re-arranged. Some annoyance from insect-pests was encountered, but they were destroyed before any considerable damage was done.

The hall is now almost too full to admit of a satisfactory arrangement of the material, and the need of additional floor-space is very apparent. How to find space for the new groups now in contemplation is a problem not easily solved.

The card-catalogue of the exhibition series was revised in February, and copy for a considerable number of new labels was prepared for the printer.

At the beginning of the year covered by this report, the experiment of converting one of the bases of the three-quarter unit exhibition cases into an insect-proof storage case was tried, and an order for reconstructing ten of these cases was approved. The cases were finished early in the year, but the trays needed for them were delayed, and only a small portion could be brought into use. Before the close of the year, however, it became apparent that even this space would not be sufficient, owing to the large amount of material deposited by the Department of Agriculture, and a plan for building fifty additional one-quarter unit storage compartments in the south entrance was approved. The work on these cases was begun at the close of the year. For large cases, four single-unit and one double-unit storage cases were constructed in the osteological hall. In the plan referred to, provision was also made for an additional storage-case for the alcoholic specimens.

All the small skulls—those of mice, squirrels, bats, shrews and moles—were put into corked vials for security. Labels on specially prepared red paper were brought into use for type specimens, of which there is a considerable number in the collection.

The experiments upon large storage-jars, mentioned in the last report, resulted in the adoption of spherical glass-jars, with wooden tops and iron clamps, for the storage of large alcoholic specimens. Six of these jars were brought into use and others have been ordered.

The ordinary routine work was greatly increased by the deposit of a large amount of material by the Department of Agriculture. More than 3,100 pieces belonging to this deposit, comprising both skins and skulls, were entered and numbered during the year. In June it was made apparent that the clerical force was insufficient to carry on this extra work promptly, and a clerk was therefore added. One osteological preparator was engaged during the year exclusively in cleaning the skulls belonging to this series, but in spite of his best efforts, they accumulated to such an extent that it was necessary at length to greatly increase the force. During June, five men worked upon this material, either as regular preparators of the Museum or by piece-work.

The lack of regular and continuous clerical assistance during the year has delayed many important operations. Dr. William G. Stimpson, who rendered efficient service for many years as an aid, resigned and was replaced by Mr. P. L. Jouy. Mr. Jouy was unfortunately absent on account of sickness on two occasions for long periods. His place was supplied on the last occasion by a temporary assistant. The copyist also resigned and was replaced at the end of the year by a clerk, who, as already explained, works exclusively upon the material deposited by the Department of Agriculture.

Orders were sent to Franz Sikora to procure certain mammals of Madagascar, at present wanting in the collection; to Mr. Charles Hallock to procure a "Brush-deer" from Minnesota, and to Mr. N. Comeau to procure a series of Gray Seals in the Gulf of St. Lawrence. None of this material was received during the year. Messrs. W. H. and A. H. Brown were attached to the United States Eclipse Expedition to Angola, Africa, to collect mammals and other animals. The specimens received from this source have been referred to on pp. 102, 103.

Special instructions for collecting, and faunal lists, were made out for Mr. Perry, who contemplated making certain explorations in Honduras; for Mr. R. M. Erving, of Boston, Massachusetts, and for Mr. W. H. Brown.

A considerable number of specimens were sent out to different institutions and individuals, as follows:

To be studied:

To Dr. J. A. Allen, American Museum of Natural History, New York; 128 skins and 58 skulls of chipmunks, genus *Tamias*.

To Dr. Harrison Allen, Philadelphia, Pennsylvania; 86 skins and alcoholic specimens of bats, and 8 skulls of the same.

To W. H. Morrow, Wilmington, Delaware; 1 Field-mouse skin.

To Mr. E. E. Thompson, Toronto, Canada; 2 skins and 2 skulls of rodents.

In exchange for other specimens:

To Prof. Robert Collett, Christiania, Norway; 1 skin and 1 skull of the fur-seal.

Dr. C. H. Merriam has repeatedly examined the series of North American animals, and has withdrawn specimens, from time to time, for study. Dr. E. A. Mearns, U. S. Army, examined the series of prairie-dogs. The curator examined into the characters of certain North American shrews and made notes upon them for Dr. G. E. Dobson, of England. Dr. D. W. Prentiss on two occasions had the use of some skins of ermines to illustrate his remarks upon changes in the color of hair.

The curator prepared, and submitted for publication, an epitome of the natural history of the puma, and brought together a considerable amount of material for an account of the natural history of other North American cats. He also prepared a description of the skeleton of the rare dolphin, *Prodelphinus longirostris*, and an account of the life history of the bottle-nose porpoise. He submitted an annotated list of the mammals collected by the United States Eclipse Expedition to Angola. Papers, based more or less largely on the Museum collection of mammals, were published during the year by Drs. Merriam, J. A. Allen, Harrison Allen, and Dobson.

In addition to his regular duties the curator has served as chairman of a committee appointed by the Assistant Secretary to consider the subject of the construction of a series of base-maps to be used in illustration of the animals, plants, ethnological objects, etc., exhibited in the Museum. The committee is constituted as follows: Mr. Frederick W. True, chairman; Dr. O. T. Mason, Dr. Leonhard Stejneger. Several meetings were held during the year, and the practical conclusions arrived at, having been approved by the Assistant Secretary, the committee has proceeded to supervise the construction of proper maps for the purpose indicated.

The condition of the collection as a whole has not changed materially since the last report. The number of specimens in the different series on June 30, 1890, was as follows:

| | |
|---|---|
| Number of mounted skins in the exhibition series | 795 |
| Number of skins in the study and duplicate series | 4,934 |
| Number of specimens in alcohol | 3,268 |
| Received during the year— | |
| Skins | 377 |
| Specimens in alcohol | 181 |
| Skeletons | 25 |
| Skulls | *283 |

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*Of these, 218 belong to skins.

# REPORT ON THE DEPARTMENT OF BIRDS IN THE U. S. NATIONAL MUSEUM, 1890.

By ROBERT RIDGWAY, *Curator.*

Speaking in general terms, the routine work has consisted of the usual duties of receiving, unpacking, cataloguing, identifying, labeling and storing specimens; correspondence; supervision of the taxidermist and his assistant, and of the carpenter engaged in remodeling the exhibition cases; re-arranging the mounted collection as the cases became ready for their reception; fastening label-clasps to the stands of the mounted collection and attaching printed labels thereto, and numerous other matters, the mention of which would render this report tedious.

The number of specimens added to the collection during 1889–'90 is considerably less than in 1888–'89; but this is rather a cause for congratulation, the cabinets being already overcrowded. A list of the principal accessions of this department will be given in full further on.

The character of routine work in the arrangement and classification of the collection, and in the preparation of the exhibition and study series, may be briefly summarized as follows:

Nothing has been done with the study series, this work being necessarily deferred till new cases are received. The exhibition series has been very greatly improved, only five cases and four wall-cases remaining to be arranged, two of the latter not having yet been remodeled, while the former were completed by the carpenter and painter during the curator's absence from Washington. These cases will be taken in hand at the earliest date practicable, and it is hoped that, excepting the wall-cases, two of which are to hold a special exhibit not yet perfected, while the other two are yet to be remodeled by the carpenter, these cases will be put in order within the next four weeks.

Among special researches prosecuted upon material belonging to the department may be mentioned the working up of the extensive collection made on the Galapagos Islands and in other parts of Tropical America by the naturalists of the *Albatross*, the results of which were published in the Proceedings of the Museum, Vol. XII, pp. 101–139; an extensive collection of Costa Rican birds, submitted for the purpose by the director of the Costa Rica National Museum; [*] a careful revision of the very difficult Dendrocolaptine genera, *Xiphocolaptes* and *Sclerurus*.[†]

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[*] Proceedings, XI, pp. 537–546.

[†] Proceedings, XII, pp. 1–31.

Dr. Stejneger has continued his important investigations on birds of Japan and the Hawaiian Islands, and has also contributed a valuable paper on the extinct Pallas Cormorant of Bering Island. Other persons, both in the United States and in Europe, have used extensively material belonging to the department in their special work or researches, particular reference to these authors and their subjects being made in the Bibliography.

In addition to researches the results of which have been published, the curator has, as time could be spared, been engaged in the preparation of manuscript for two Museum publications, designed as handbooks of reference to the exhibition collection, which are designed to, and it is hoped will, meet a popular want. These hand-books pertain to the humming-birds and the game-birds, respectively. The former is published in this volume as a special paper in section III. Much work has been done on the latter, about 270 pages of copy having been written, and it will be finished as soon as it is practicable to do so, the very numerous duties of the curator prohibiting continuous work on them for any considerable time.

The present state of the collection is satisfactory, except as regards arrangement, which, however, can not be remedied until new cabinets are provided. The skin collection, both study-series and duplicate series, urgently requires re-arrangement, which will be commenced as soon as the necessary cabinets are received.

The mounted collection, so far as arranged, is in excellent condition as regards the preservation of the specimens, and is fairly satisfactory in arrangement. The present arrangement, however, is only temporary, and will be revised after the provisional re-arrangement has been completed. Nine and one-half cases altogether, including wall-cases, are yet to be arranged, and the curator hopes that he will be able to resume that important part of his work very soon.

The number of specimens in the skin collection can be only approximately given, it being impracticable at the present time to make an actual count. Taking the estimated number of last year as a basis, and applying the same method to estimating the increase of this year, the total number of specimens in the collection of the Department of Birds at the end of June, 1890, is about as follows:

| | 1888-'89. | 1889-'90. | Increase. | Decrease. |
|---|---|---|---|---|
| Reserve skin series | 45,450 | 46,543 | 1,084 | .......... |
| Duplicate skin series | 6,756 | 6,543 | ......... | 213 |
| Exhibition series | 6,714 | [*]7,133 | [†]419 | .......... |

[*] By actual count.

[†] Part of specimens mounted during latter part of 1888-'89, but not in cases when count for the year was made.

The last entry in the catalogue in June, 1889, is 116,630; the last one in June, 1890, is 118,369; the total additions during the year numbering

1,730, though after deducting the 559 specimens exchanged, the net increase is only 1,171 specimens.

A tabulated statement of the taxidermic work accomplished for this department is here presented:

| | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | April. | May. | June. | Total. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Birds mounted | 32 | 30 | 25 | 26 | 10 | 14 | 19 | 20 | 40 | 35 | 30 | 29 | 310 |
| Birds skinned and made into skins | .. | .. | 5 | 12 | 4 | 38 | 2 | 10 | 5 | 2 | 1 | 4 | 83 |
| Mounted birds repaired | ... | 2 | .... | ... | 3 | 4 | 4 | ... | ... | ... | ... | .... | 13 |
| Mounted birds made over into skins | 3 | 5 | 1 | .... | .. | 2 | .. | ... | .. | .... | ... | ... | 11 |
| Mounted birds put on new stands | 16 | 132 | 26 | 10 | ... | ... | 30 | 16 | 19 | 15 | ... | ... | 204 |
| Skins cleaned and made over | ... | ... | 10 | 22 | 10 | 12 | ... | ... | .. | .... | .. | .... | 54 |
| Skins poisoned | ... | ... | 32 | ... | ... | ... | 57 | ... | ... | ... | .. | ... | 89 |
| New stands made up | 19 | 122 | 3 | 7 | ... | 2 | 14 | 2 | 8 | 8 | ... | .... | 185 |
| Nests mounted | ... | ... | .... | ... | ... | ... | ... | ... | 294 | .... | ... | .... | 294 |
| Nests wired and hung in cases | ... | ... | .... | ... | ... | ... | .. | ... | 17 | ... | .... | .... | 17 |

The following is a list of the principal or more important accessions during the fiscal year 1889–'90:

From L. Belding, Stockton, California, 7 specimens, 4 species, from California, including an example of the recently described *Turdus sequoiensis*, Belding. (Gift.)

From R. W. Shufeldt, Tacoma Park, District of Columbia, 1 specimen of *Junco hyemalis shufeldti*, from Fort Wingate, New Mexico. (Exchange.)

From T. McIlwraith, Hamilton, Ontario, Canada, 4 specimens, 4 species, from British Columbia. (Exchange.)

From B. M. Hayward, Middlebury, Vermont, 12 specimens, 10 species, from Monterey, Mexico. (Exchange for naming collection.)

From Louis Molnar, Molna Szecsöd, Hungary, 86 specimens, 71 species, from Hungary. (Exchange.)

From Valdemar Knudsen, Kauai, Sandwich Islands, 48 specimens, 19 species, from Kauai. (Gift.)

From R. Ridgway, U. S. National Museum, 45 specimens, 37 species, chiefly from Laurel, Maryland. (Gift.)

From C. J. Maynard, Newtonville, Massachusetts, 5 specimens of *Sula coryi*, from Little Cayman, West Indies. (Purchased.)

From Dr. E. Rey, Leipsic, Germany, 4 specimens, 3 species, from Syria and Canary Islands. (Purchased.)

From Colonial Museum, Demerara, British Guiana (through J. J. Quelch, Curator), 4 skins and 6 alcoholic specimens of the young of the Hoatzin (*Opisthocomus cristatus*).

From Dr. E. Rey, Leipsic, Germany, 8 specimens, same number of species, from Siberia, etc., all except two new to the collection. (Purchased.)

From A. Boucard, Paris, France, 7 specimens, same number of species, Birds of Paradise, all new to the collection. (Purchased.)

From L. Stejneger, Flagstaff, Arizona, 10 specimens, 9 species, from Arizona. (Collected for the Museum.)

From L. Stejneger, 19 specimens, 17 species, from Arizona; 17 specimens, 17 species, from New Mexico. (Collected for the Museum.)

From Valdemar Knudsen, Kekaha, Waiawa, Hawaiian Islands, 2 specimens of Bulwer's Petrel (*Bulweria bulweri*), from the Sandwich Islands. (New to the Hawaiian fauna.) (Gift.)

From Dr. C. H. White, U. S. Navy, 9 specimens, 6 species, from Samoa. (Gift.)

From R. M. McFarlane, Hudsons Bay Company, 102 specimens from British Columbia. A valuable collection, as extending the range of many species. (Gift.)

From Leverett M. Loomis, Chester, South Carolina, 7 specimens, 5 species, from South Carolina. (Gift.)

From American Museum of Natural History, New York City, 212 specimens, 63 species, from Arizona. (Exchange.)

From Leonhard Stejneger, Smithsonian Institution, 8 specimens, 7 species, from Arizona and New Mexico. (Collected for the Museum.)

From Leverett M. Loomis, Chester, South Carolina, 33 specimens, 11 species, from South Carolina. Five accessions. (Gift.)

From Frank Burns, Bristol, Florida (U. S. Geological Survey), 1 Ivory-billed Woodpecker, and 1 Pileated Woodpecker, in the flesh, from Florida. (Purchased for the Museum.)

From A. Boucard, Paris, France, 1 specimen of the Magnificent Rifle Bird (*Craspedophora magnifica*), from New Guinea. (Purchased.)

From R. Ridgway, Smithsonian Institution, 1 specimen of Greater Snow Goose (*Chen hyperboreus nivalis*), in the flesh. (Purchased for Museum in Washington market.)

From R. Ridgway, Smithsonian Institution, 26 specimens, 9 species, chiefly from Maryland. (Gift.)

From R. Ridgway, Smithsonian Institution, 2 wild turkeys (*Meleagris gallapavo*), purchased in the Washington market. (Two accessions.)

From Dr. S. J. Call, Paso Robles, California, 55 specimens, 27 species, from Alaska. (Gift.) (Through Mr. H. W. Elliott.)

From Dr. Wm. C. Avery, Greensborough, Alabama, 12 skins of Quiscalus, from Alabama. (Gift.)

From George B. Sennett, Erie, Pennsylvania, 1 specimen of *Thryothorus ludovicianus lomitensis*, new subspecies, from Texas. (Exchange.)

From A. Nehrkorn, Riddagshausen, Braunschweig, Germany, 5 specimens, 5 species, from Palawan. (Exchange.)

From U. S. Fish Commission (through Col. Marshall McDonald, Commissioner), 226 specimens from islands off western Mexico, California, etc.

From James T. Jones, Washington, District of Columbia, 1 Double-breasted Cormorant (*Phalacrocorax dilophus*), from Potomac River. (Gift.)

From Dr. James Rodman, Lexington, Kentucky, 1 Superb Bird of Paradise (*Lophorina superba*), from New Guinea. (Purchased.)

From George Marshall, Laurel, Maryland, 1 female Mallard Duck (*Anas boschas*), from Laurel, Maryland. (Gift.)

From Dr. Joseph L. Hancock, Chicago, Illinois, 14 specimens, 14 species, from India. (Gift.)

From Rev. George B. Winton, San Luis Potosi, Mexico, 4 specimens, 3 species, from San Luis Potosi. (Gift.)

From Ernest E. Thompson, Toronto, Canada, 15 specimens, 8 species, from Ontario. (Exchange for courtesies.)

From Dr. Juan Gundlach, Havana, Cuba, 18 specimens, 9 species, from Cuba. (Gift.)

From Z. D. Gilman, Washington, District of Columbia, 1 Bald Eagle, in the flesh, from Prince George's County, Maryland. (Gift.)

From H. K. Coale, Chicago, Illinois, 1 Broad-winged Hawk with well-developed toe and claw growing from the thigh. (Gift.)

From George Marshall, Laurel, Maryland, 1 male Mallard and 1 male Hooded Merganser, in the flesh, from Laurel, Maryland. (Gift.)

From Dr. W. C. Rives, Newport, Rhode Island, 2 skins of *Vireo solitarius alticola*, from Whitetop Mountain, Virginia; new to the collection. (Gift.)

From Dr. W. L. Abbott, Zanzibar, Africa, 577 specimens (number of species not yet determined) from the region about Kilima-Njaro, East Africa. (Gift.)

From Government of Nicaragua, 9 specimens, 9 species, from Nicaragua. (Gift.)

From Dr. Alfred Dugès, Guanajuato, Mexico, 4 specimens, 4 species, from Mexico. (Gift.)

From Dr. James C. Merrill, U. S. Army, Fort Reno Indian Territory, 4 specimens, 3 species, from Indian Territory. (Gift.)

# REPORT ON THE DEPARTMENT OF BIRDS' EGGS IN THE U. S. NATIONAL MUSEUM, 1890.

By CHAS. E. BENDIRE, U. S. A., *Honorary Curator.*

The routine work has been as follows: Taking the measurements of, numbering, and arranging 739 specimens; relabeling and arranging part of the reserve series of eggs, after the check-list of the American Ornithologists Union; revising and arranging in numerical order a large number of register sheets; and determining the average measurements of each genus thereon recorded.

In addition to the routine work, I have been, and am at present, engaged in writing a work on the "Life Histories of North American Birds," with especial reference to their breeding-habits and eggs. Some 80 species have already been written up, and the manuscript for volume I will be ready by January 1, 1891.

The following important accessions were received during the year:

From Lieut. H. C. Benson, U. S. Army, Fort Stanton, New Mexico, 3 eggs of *Cyanocitta stelleri macrolopha* (Baird). (Gift.)

From Lieut. M. H. Barnum, U. S. Army, Marathon, Texas, 12 eggs of *Callipepla squamata.* (Gift.)

From Dr. C. Hart Merriam, Washington, District of Columbia, 4 eggs of *Picoides americanus.* (Gift.)

From Mr. Herbert Brown, Tucson, Arizona, a handsome series of selected eggs from Arizona, containing 21 sets of *Harporhynchus curvirostris palmeri*, and others equally interesting. (Gift.)

From Mr. R. MacFarlane, chief factor of the Hudsons Bay Company, an exceedingly valuable collection of nests and eggs, made near Fort St. James, New Caledonia District, including, among many others, such rare eggs as those of *Dendragapus franklini, Totanus melanoleucus, Junco oregonus shufeldti, Empidonax hammondi*, and others equally rare. (Gift.)

From Mr. Denis Gale, Gold Hill, Boulder County, Colorado, a beautifully prepared lot of nests and eggs from Colorado, all important acquisitions; among them 1 set, 4 eggs of *Megascops asio maxwelliæ;* 1 set, 3 eggs of *Nyctale acadia;* 1 set, 4 eggs of *Falco peregrinus anatum;* 1 set, 3 eggs and nest of *Contopus borealis;* 1 set, 4 eggs and nest of *Empidonax difficilis;* 1 set, 4 eggs and nest of *Cyanocitta stelleri macrolopha*, and others. (Gift.)

From Mr. A. M. Ingersoll, San Diego, California, 3 eggs and nest of *Ammodramus beldingi.* New to the collection. (Gift.)

From Mr. A. W. Anthony, San Diego, California, 1 set, 3 eggs of *Pelecanus californicus* New to the collection. (Gift.)

From Mr. William Brewster, Cambridge, Massachusetts, 1 egg each of *Tympanuchus cupido*, and *Columba fasciata viosca*, both very rare and new to the collection. (Gift.)

From Mr. L. Belding, Stockton, California, nest and 3 eggs of *Contopus borealis*; nest and 2 eggs of *Ammodramus beldingi*; both rare and desirable additions. (Gift.)

From Mr. J. F. Menge, near Fort Thompson, Florida, 1 nest of *Rostrahamus sociabilis*. New to the collection. (Gift.)

From Assistant Surgeon J. C. Merrill, U. S. Army, Fort Reno, Indian Territory, 14 eggs of *Tympanuchus americanus*, and a number of others. (Gift.)

From Mr. R. B. McLaughlin, Statesville, North Carolina, 2 nests and 8 eggs of *Vireo solitarius alticola* (Brewst.). New to the collection. (Purchased.)

From Mr. J. W. Southwick, Providence, Rhode Island, 1 nest and 3 eggs of *Piranga hepatica*. New to the collection. (Purchased.)

From Mr. J. F. Menge, near Fort Thompson, Florida, 6 eggs of *Speotyto cunicularia floridana*. (Purchased.)

During the year ninety-nine nests have been received, many of which are rare.

The following statement shows the condition of the collection at the present time:

| | |
|---|---|
| Number of specimens in North American reserve series | 31,287 |
| Number of specimens in North American duplicate series | 11,548 |
| Number of specimens in North American series on exhibition | 1,491 |
| Total | 44,326 |
| Number of species in North American series | 749 |
| Number of specimens in foreign reserve | 4,193 |
| Number of specimens in duplicate series | 231 |
| Total | 4,424 |
| Number of species in foreign series | 611 |
| Number of nests in reserve series | 2,256 |
| Number of nests on exhibition | 235 |
| Current number last entry, June 30, 1889 | 23,765 |
| Current number last entry, June 30, 1890 | 24,004 |
| Total number of entries | 239 |

Two papers were published during the year in "The Auk." These are noticed in the Bibliography (section IV).

# REPORT ON THE DEPARTMENT OF REPTILES AND BATRACHIANS IN THE U. S. NATIONAL MUSEUM, 1890.

By LEONHARD STEJNEGER, *Curator.*

The reorganization of the department and overhauling of the reptile collection, begun during the year 1888–'89, has been continued, except during an interval of three months, in which the curator was absent on a collecting trip in the West, and the daily routine work of the department was consequently suspended. As the curator was without an assistant most of the time, the work has, of necessity, been of slow progress, the more so since the collection had to be moved into new quarters. As these are, however, commodious and healthy, the future work of the the department may be expected to progress more rapidly.

The removal of the North American lizards into the new quarters, and their installation on the shelves, was completed during the year, and this part of the collection catalogued and counted. The total number of the identified specimens of the reserve series of North American lizards was 2,752. Several genera had to be worked up monographically, in order to settle many intricate points of identification and nomenclature; while in others, the arrangement is only provisional until the whole subject can be investigated.

Quite a number of interesting collections were received during the year, the total number of specimens entered being 705.*

Foremost in importance among these is the collection of reptiles and batrachians made by Dr. C. Hart Merriam and his assistants during the summer of 1889, while engaged in an exploration of the fauna and flora of the San Francisco mountain plateau, Arizona, a part of the general biologic survey of the country undertaken by the U. S. Department of Agriculture. The curator has already reported in detail upon this collection, and the report is now going through the press.

The U. S. Fish Commission has, as usual, added materially to the collections of this department, the contribution this year being 128 specimens, collected partly by the naturalists attached to the steamer *Albatross*, and partly by Dr. D. S. Jordan and his assistants. The *Albatross* collections were made chiefly in the islands off the coast of

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* The number entered in 1888–'89 was 781; in 1887–'88, 19; in 1886–'87, 138.

Lower California. They contain many rare species, and Mr. Charles H. Townsend, resident naturalist of the *Albatross*, has made a special report upon them, which will soon be published.

Quite a number of specimens were received from the naturalists attached to the United States Eclipse Expedition to West Africa in 1889. This collection was not in a very satisfactory state of preservation, and, since the collections were made under apparently unfavorable circumstances in localities already more or less explored, they could hardly be expected to contain many novelties.

Among the many other contributors, the following deserve special mention: Herbert Brown, Tucson, Arizona; G. H. Ragsdale, Cook County, Texas; J. F. Le Baron, San Juan, Nicaragua; Capt. W. L. Carpenter, U. S. Army, Fort Whipple, Arizona; Julius Hurter, St. Louis, Missouri; Dr. W. L. Abbott, Zanzibar, East Africa; Prof. O. B. Johnson, Seattle, Washington.

During a three months' trip to Arizona, New Mexico, and Texas, the curator collected a number of reptiles, chiefly lizards, and also a number of birds and mammals. In spite of the lateness of the season—from September to November—interesting material was brought home, which, when fully worked up, will add considerably to our knowledge of the geographical distribution of the western species.

In addition to the ordinary routine work, consisting in caring for, registering, identifying and labeling the new accessions, much time has been spent in correcting and verifying the records of the collections already at hand. Moving the collection from the old quarters in the basement to the new ones in the top rooms of the south tower, Smithsonian building, has also consumed considerable time, as the opportunity was improved to re-catalogue the collection as the jars were placed in the new cases. This work is not yet completed.

A great improvement in the storing of the specimens has been effected during the year. The new quarters have been fitted with unit cases which take the standard museum drawers.

The new accessions have not been distributed between the "reserve series" and the "general series," for the reason that such a division of the material can only be made when the whole collection has been worked up. The status of North American herpetology at the present date is so unsettled that in most cases it is impossible to tell whether a specimen is a duplicate, or whether it may not be of extreme importance when the matter is thoroughly investigated. It seems probable that in the near future, new views and new methods in the treatment of the geographic distribution and the systematic technicalities will be tested, and a separation as alluded to must therefore now be regarded as premature and unwise. It has, consequently, been deemed inexpedient also to make too great inroads on the so-called duplicates of the "general series" for distribution, as it is extremely probable that it contains some very valuable material which should not be disposed of until utilized.

Dr. G. Baur, late of Yale College, was given an opportunity to work up the collection of Chelonians, with special reference to the North American species. He left Washington, however, before the task was completed.

The curator has made special researches during the year into the geographic distribution of the reptiles and batrachians of the southwestern territories of the United States. A few of the results of these studies are embodied in the report he made upon the collections brought home by Dr. C. Hart Merriam, from the San Francisco mountain plateau, Arizona. He has also submitted, for publication in the Proceedings of the National Museum several minor papers describing a number of new species, as well as a new genus, of North American snakes (*Phyllorhynchus browni* n. g. and sp.) besides a more extensive memoir treating of the individual variation in the genus *Charina.*

The assistant, formerly connected with the department, resigned his position in the early part of the year, and the curator has since performed all the various duties without any aid, save that of some laborers in carrying the jars from the basement to the present office. As a result, it has been impossible to institute a detailed count of the collection. The following estimate of the number of specimens is based upon that of last year by adding the number of entries catalogued during the present year and deducting those which have been disposed of in exchange or transferred to the Department of Comparative Anatomy. According to this estimate the status of the collection on June 30, 1890, is as follows:

| | Specimens. |
|---|---|
| Reserve series | 13,970 |
| Duplicate series | 8,758 |
| Unassorted and exotics | 6,313 |
| Total | 29,041 |

The last catalogue entry in June, 1889, was 15,523; and in June, 1890, 16,228.

# REPORT ON THE DEPARTMENT OF FISHES IN THE U. S. NATIONAL MUSEUM, 1890.

By TARLETON H. BEAN, M. D., *Honorary Curator.*

Under instructions from the U. S. Commissioner of Fish and Fisheries, I left Washington on the 19th of June, 1889, for Alaska, to examine and report upon the condition of the salmon rivers and fisheries of that territory. This investigation covered a period of several months, and I did not return to Washington until October 13. After my return I prepared a report covering 170 manuscript pages, which will be printed by order of Congress, as a House document. The general routine work of the department was carried on by my assistant, B. A. Bean, alone, until January 1, 1890, when the force of the office was increased by the appointment of A. S. Herr, as skilled laborer. On February 1, the work of picking out duplicates and disposing of worthless material was begun. A series of east coast fishes was sent to the Boston Society of Natural History. Hundreds of specimens have been selected for distribution to other museums, and much bad matter has been cleared out, thus relieving the overcrowded shelves. As this work progresses, the collections are receiving attention generally. Tin-tags, labels, and alcohol are supplied where needed. A full series of each species from a locality is kept, and great care is being taken to reserve enough for the needs of the Museum.

## ACCESSIONS.

The total number of accessions during the year is 38, several of which are large; notably, a box from Switzerland containing 45 species, represented by 89 specimens. A very large collection of Pacific fishes from Galapagos Islands, Panama, etc., collected by the U. S. Fish Commission steamer *Albatross* in 1888, has been received. This collection contains numerous types of new species, papers upon which have been published in the Proceedings of the U. S. National Museum. A collection of South American *Siluroids* was received from the Museum of Comparative Zoölogy, of Cambridge, Massachusetts. Many of these were desiderata. A series of the fishes collected in the Yellowstone Park during September and October, 1889, was received from the U. S. Fish Commission. A large collection of British Columbian and Alaskan species, collected by the steamer *Albatross*, was also received from the U. S. Fish Commission, as well as a type series of fishes collected in Colorado, Utah, and Kansas, in the summer of 1889, by Dr. D. S. Jordan and party. A small collection of Mexican fishes, containing a new species of Algansea, was received from Prof A. Dugès. Collections from San Diego Bay, etc., containing 17 new forms, were received from Dr. and Mrs. C. H. Eigenmann. A very large collection was received from the United States Eclipse Expedition of 1889 to West Africa, collected by Mr. W. H. Brown. A box of Percoid fishes from the Australian Museum of Sydney, in exchange for American fishes, was also received. A complete list of accessions for the year ending June 30, 1890, is as follows:

*July* 10, 1889.—Accession 22195; Cat. No. 41045: One large stuffed skin of sawfish, *Pristis pectinatus*, from the U. S. Fish Commission.

*July* 15.—Accession 22211; Cat. No. 41046: One fresh-water sculpin, *Uranidea richardsoni*, from Virginia. By Dr. H. C. Yarrow.

*July* 20.—Accession 22231; Cat. No. 41047: One specimen of *Nomeus gronovii*, taken at Menemshe Bight, near Wood's Holl, Massachusetts. By V. N. Edwards.

*July* 23.—Accession 22242; Cat. No. 41049: One specimen of bat fish, *Malthe cubifrons*, from Florida. By V. O. Spencer.

*July* 26.—Accession 22246; Cat. No. 41048: One specimen of *Elacate canada* (head), from Center Market, Washington, District of Columbia. By R. A. Golden.

*July* 31.—Accession 22255; Cat. Nos. 41050, 41051: Two fresh trigger fish, *Balistes capriscus*, from Wickford, Rhode Island. By George A. Lewis.

*August* 26.—Accession 22298; Cat. Nos. 41058–41126: Box of alcoholic specimens of fishes, 45 species, represented by 89 specimens, from Switzerland. By the federal department of industry and agriculture, Berne, Switzerland.

*August* 26.—Accession 22301; Cat. No. 31987: A small collection of fishes, made in the vicinity of Washington. By Mr. H. W. Henshaw.

*September* 6.—Accession 22329; Cat. Nos. 41056, 41057: Three fresh scabbard fish, *Trichiurus lepturus*, and one specimen of *Selene vomer*, taken at Piney Point, Maryland, in seine of Edgar Poe. Received from Gwynn Harris.

*September* 26.—Accession 22383; Cat. No. 41128: One fresh *Trichiurus lepturus*, taken in Narragansett Bay. Received from George A. Lewis.

*October* 4.—Accession 22404; Cat. No. 41127: One fresh specimen of sheepshead, *Diplodus probatocephalus*, from Chesapeake Bay. By Wm. P. Seal, U. S. Fish Commission.

*October* 10.—Accession 22423; Cat. Nos. 41129–41131: Two fresh specimens of chain pickerel, *Esox reticulatus*, and one specimen of *Cynoscion regale*, from the U. S. Fish Commission, Washington, District of Columbia.

*October* 15.—Accession 22417; Cat. Nos. 41132–41171 and 41174–41494; Three tank boxes and one 8-gallon tank, containing a large collection of fishes from the Galapagos Islands, Panama, etc.; in which were many types of new species. Collected by the U. S. Fish Commission steamer *Albatross* during the spring and summer of 1888. Paper, based upon these, published in Proceedings, U. S. National Museum.

*October* 18.—Accession 22456; Cat. No. 41593: One specimen of anchovy, *Stolephorus delicatissimus*, from San Diego, California. By C. R. Orcutt.

*October* 30.—Accession 22499; Cat. Nos. 41551–41567: A small collection of fishes from the Samoan Islands, made by Dr. C. H. White, Medical Inspector, U S. Navy.

*November* 4.—Accession 22517; Cat. Nos. 41568–41575: One specimen of California trout, *Salmo irideus:* four specimens of *Gila;* two specimens of *Squalius*, and one of *Catostomus*, from Fort Verde. By W. L. Carpenter, Captain Ninth Infantry, U. S. Army, Fort Whipple, Arizona (through Dr. L. Stejneger).

*November* 6.—Accession 22524; Cat. No. 41780: Eight specimens of *Heterandria occidentalis*, from Calabasas, Arizona. By Dr. L. Stejneger.

*November* 7.—Accession 22526; Cat. Nos. 41495–41550: One can alcoholic specimens of South American *Siluroids*, from Museum of Comparative Zoölogy, Cambridge, Massachusetts.

*November* 8.—Accession 22533; Cat. Nos. 41577–41586: One box fresh specimens of eels, large and small-eyed *Anguilla*, from Wood's Holl, Massachusetts. U. S. Fish Commission (through V. N. Edwards).

*November* 15.—Accession 22562; Cat. No. 41592: One can, containing one large, fresh specimen of menhaden, *Brevoortia tyrannus*, 17 inches in length, captured off Long Branch, New Jersey, November 6, 1889, by steamer *Geo. W. Humphrey*. From Joseph Church & Co., Tiverton, Rhode Island.

*November* 19.—Accession 22571; Cat. Nos. 41590–41591: Two fresh specimens of *Salvelinus aureolus*, from Dan Hole Pond, New Hampshire. By Col. E. B. Hodge.

*November* 25.—Accession 617; Pharyngeal bone of *Haploidonotus grunniens*. From I. R. S. Nye, Pocahontas, Tennessee. (Specimen returned.)

*November* 25.—Accession 22592; Cat. Nos. 41587–41589: One small bottle containing *Semotilus corporalis*, one specimen; *Phoxinus neogæus*; one specimen; *Rhinichthys atronasus*, one specimen. From Philip Cox, Newcastle, New Brunswick.

*December* 26.—Accession 22722; Cat. No. 43079. Full set of pharyngeals of *Pogonias chromis*. From R. L. Garner, Mathews Court House, Virginia.

*January* 23, 1890.—Accession 22807; Photograph of fish taken by hook and line in Smith Bay, Cerros Island, Lower California. (Photograph, 5 by 8 inches) *Heterodontus francisci*. From Charles F. Pond, lieutenant, U. S. Navy, U. S. S. *Ranger*, Navy Yard, Mare Island, California.

*January* 27.—Accession 22828. Cat. Nos. 41605–41622; Type series of fishes collected by Dr. D. S. Jordan in the Yellowstone Park, during September and October, 1889. In good condition. U. S. Fish Commission, Washington, District of Columbia.

*February* 3.—Accession 22851; A collection of fishes from British Columbia and Alaska, contained in 45 jars, 50 bottles, and 21 vials. Collected by the steamer *Albatross*, U. S. Fish Commission, Washington, District of Columbia.

*February* 3.—Accession 22852; Cat. Nos. 41624–41727: Type series of fishes collected in Colorado, Utah, and Kansas, in the summer of 1889, by Dr. D. S. Jordan and party. In good condition. U. S. Fish Commission, Washington, District of Columbia.

*February* 20.—Accession 23254; Cat. Nos. 41813–41819: A small collection of fishes, containing one new species—*Algansea dugesii*—from Mexico. Sent by Dr. Alfred Dugès, of Guanajuato, Mexico.

*March* 3.—Accession 22916; Cat. No. 41834: Two salt mackerel, *Scomber pneumatophorus*, caught by the schooner *Alice*, Capt. Jonas A. Chase, at Cape Town, Africa (Table Bay).

*March* 10.—Accession 22956; Cat. Nos. 41858–41926: Collection of fishes, in alcohol, from San Diego Bay, Cortez Banks, and Temecula River. Seventeen new forms. Carl H. and Mrs. Rosa Smith Eigenmann, San Diego, California.

*March* 11.—Accession 22959; Cat. No. 41856: One specimen, *Ostracion quadricorne*, caught in the harbor of El Portillo, south side of Cuba. It is called by the natives "Chappin," pronounced "Chappeen." (Toro or Chapin: see Poey, Report Fisico Nat. de la Isla de Cuba, p. 439.) From C. H. Rockwell, Commander, U. S. Navy, commanding U. S. steamer *Yantic*, Santiago de Cuba.

*May* 5.—Accession 23158; Cat. No. 41979: One dried skin of *Chromis niloticus*, from Lake Chala, Kilima-Njaro, Zanzibar, Africa. Collected July 3, 1888. From Dr. W. L. Abbott, care of E. D. Ropes, jr., Zanzibar, East Africa.

*May* 8.—Accession 23169, Cat. No. 41978: One fresh specimen of white fish, *Coregonus labradoricus*, 11 inches in length; packed in salt; condition very good. Received from E. Phinney, Cooperstown, N. Y.

*June* 5.—Accession 23272, Cat. Nos. 42116–42372 and 42386–42388: A very large collection of marine and fresh-water fishes obtained by the U. S. Eclipse Expedition to the western coast of Africa, per U. S. steamer *Pensacola*. By W. H. Brown, collector.

*June* 17.—Accession 23308, Cat. Nos. 41996–42039: One box of fishes, chiefly *Percoids*; 30 species; 44 specimens. From the Australian Museum, Sydney.

*June* 19.—Accession 23321, Cat. Nos. 42040–42058: From O. B. Johnson, University of Washington, Seattle, Washington, the following specimens in alcohol: *Oncorhynchus nerka*, ovaries developed, numerous examples from 9 to 10¼ inches long; *Salvelinus malma*, *Stromateus*, *Blepsias*, *Oxylebius*, *Zaniolepis*, *Gobiesox*, *Xiphister*, *Artedius* (apparently three species), *Murænoides*, *Anoplarchus*, *Nautichthys*, *Hemilepidotus*, and *Hexagrammus*.

*June* 20.—Accession 23322: Herring in salt; *Clupea vernalis*. Found dead in a brook. From E. P. Cook, Wellfleet, Massachusetts.

## SPECIAL RESEARCHES.

During the year (1889) in August and September, the curator, accompanied by Messrs. L. Stone, Franklin Booth and Robert Lewis, made an investigation of the salmon and salmon rivers of Alaska, especially on Kadiak Island, where many photographs illustrating the methods of taking and canning the salmon, the canneries, fishing fleets, and the spawning-grounds of the salmon were obtained. This investigation was ordered by Congress, and the report was published as House Document No. 211 (51st Congress, 2nd session), and will be republished in the Bulletin of the U. S. Fish Commission.

The principal results of the expedition were announced by me in a lecture before the scientific societies of Washington, delivered in the U. S. National Museum in March, 1890. I found that the red salmon was the most abundant and most important commercially, and that as many as seventeen thousand were taken at a single seine haul at Karluk. The verification of the statements as to the excessive mortality in the genus *Oncorhynchus* during the spawning season was one of the important results of this exploration. In the case of the red salmon the destruction was found to be almost total, and in the dog salmon it was found that all of the fish died after spawning. Collections of the river fishes associated with the salmon, and of the fish, mainly sculpins, which devour the eggs and young of the *Oncorhynchi*, as well as of the fish-destroying birds and of the plants of the Karluk River and Valley, were brought down by the party.

During September and October (1889), Dr. D. S. Jordan and party, of the Indiana State University, under the direction of the U. S. Fish Commission, explored, and collected natural history specimens in the

Yellowstone National Park. A type series of the fishes obtained is now in this Museum. Dr. Jordan and party also collected in Georgia, Alabama, Missouri, Arkansas, Colorado, Utah, and Kansas, during the summer of 1889, and as a result of this work the Museum has received from the Fish Commission a large series of fishes. The U. S. Fish Commission steamer *Albatross* carried on explorations in Alaska and British Columbia, collecting many new and interesting fishes, mainly in deep water. Dr. and Mrs. C. H. Eigenmann collected in San Diego Bay, Cortez Banks and Temecula River, California, obtaining 17 new forms of fishes. The United States Eclipse Expedition to West Africa brought a large collection of fishes from the Azores, St. Vincent, Free Town, Elmina, St. Paul de Loanda, Angola, Ascension Island, St. Helena, and Cape Town. The collections were made by Messrs. W. H. Brown and A. H. Brown, who accompanied the expedition in the interests of the Museum.

Dr. Gill has drawn largely upon the collection for such subjects as he has required in his work upon the different orders of fishes. His papers upon these are referred to in the Bibliography (section IV of this volume).

### THE PRESENT STATE OF THE COLLECTION.

In the work of picking out duplicates, the condition of the collection is being much improved. The jars throughout the west basement have been cleaned; the alcohol changed, where needed; and many specimens have been identified and labeled. Groups of fishes are brought more closely together as room is made and opportunity offers. If it were not for the overcrowded condition of the basement, a very good arrangement of the collections could be made.

The first entry number in the catalogue in July, 1889, was 41045, and the last entry in June, 1890, was 42060; making the number of entries for the year, 1,016.

*Approximate Number of Specimens in the Collection.*

| | |
|---|---|
| Exhibition | 30,000 |
| Reserve | 62,000 |
| Duplicate | 30,000 |
| Total | 122,000 |

The estimated number in the exhibition series is the same as given last year. There have been numerous additions to this series, but almost an equal number of duplicates have been selected from it.

# REPORT ON THE DEPARTMENT OF MOLLUSKS IN THE U. S. NATIONAL MUSEUM, 1890.

By **Wm. H. Dall**, *Honorary Curator.*

As in previous years, by permission of the director of the U. S. Geological Survey, the curator has devoted a portion of his time to the duties of the curatorship, as Dr. R. E. C. Stearns has done in the capacity of adjunct curator, while Mr. Frank Burns and Mr. Gilbert D. Harris, of the U. S. Geological Survey, have lent their aid in the work from time to time with important results.

Since obtaining Mr. Simpson's assistance we have been able to delegate to him a large amount of work which hitherto has been delayed on account of the lack of competent assistance in the scientific work of the department. Mr. Bond has carefully and faithfully performed all that has been required of him. Miss Beard, whose work while detailed to the department has been chiefly confined to sorting over the fine gravel and bottom material obtained from deep-sea dredgings, has made satisfactory progress. The department has never before been so well equipped, and the result is highly satisfactory. It gives me pleasure also to record the fact that for the first time in its history, this department has been well supplied with cases for the specimens, to protect them from dust and for the display of a portion of the collection. These cases, which occupy the middle aisle of the lower Smithsonian hall, are partly of the double Liverpool pattern and partly flat storage-cases with table tops. They now await only the locks to the upright center pieces of the Liverpool tables, and the assistance of a carpenter. They will then be ready for use. Whether immediate use will be made of the facilities for exhibition which the glazed tops afford, will depend upon the decision of Congress in regard to the appropriation for altering and repairing the Smithsonian building. If this is made, and the ceiling of the lower hall cut through, as has been planned, it will be undesirable to attempt any arrangement for exhibition purposes which would be allowed to remain undisturbed for only a few weeks. The arrangement of this part of the collection will therefore be deferred until the question of the proposed changes in the hall has been decided. On the other hand, if no changes are made at present, the installation of the exhibit will be commenced as soon as practicable. Few of the exhibits of the biological departments of the Museum seem to have the attractiveness for the general public possessed by shells, and the small exhibit hitherto made and lately necessarily disturbed, has attracted considerable attention.

## GENERAL OPERATIONS.

The general operations of the Department during the past year, as in previous years, have consisted (1) in the determination, labeling, proper assorting and registration of material, old and new; and (2) in the preparation of special reports on Government collections made by other branches of the Executive Departments, as the U. S. Fish Commission, the Navy, the Revenue Marine, the Department of Agriculture, and special expeditions.

As will be seen in the special table showing the number of registrations, they have amounted to about the same as in the year preceding, but it is proper to observe that a much greater amount of systematizing of the registered material has gone on than for many years, now that Mr. Simpson, with his knowledge of the subject, has been available. Another six months will see a vast clearance of material which has been almost but not quite ready for incorporation in the general series, but such steps in our progress make no changes on the registers.

In the second class of work, a preliminary report on the collections made during the voyage of the *Albatross* to California has been made and printed. A report on the collections made on the Eclipse Expedition of 1890 is nearly ready, and a large number of reports on collections submitted for examination have been attended to during the year.

The unregistered collections of tertiary fossils have been cleaned and arranged by Mr. Burns, so that they are ready for study at any time and also for reference. A report has been in progress by the curator on the Plio-Miocene Mollusk fauna of Florida, of which the first part is now being printed by the Wagner Free Institute of Science in Philadelphia, which has coöperated in the work.

## ACCESSIONS DURING THE YEAR.

The number of accessions for the year is 87. In the preceding year the number was 46. The amount of material received *in toto* during the year is, however, considerably less than during last year, since in 1889 were included the collections made by the *Albatross* on her voyage from Norfolk, Virginia, to San Francisco, which, under one accession number, included a multitude of specimens. It is fortunate for the curator that the Department of Mollusks does not receive such an accession every year, since, if it did, there would be no hope of overcoming the arrears of the last 15 years.

None of the collections represented by the accessions of the year were particularly valuable, while on the other hand none, or very few, were without interest. The total number of specimens received will not amount to less than 3,500, representing about 1,200 species. Entries of all the accessions will be found in section V of the Report.

Our faithful and generous correspondent in California, Mr. Henry Hemphill, has presented a series of more than 600 specimens from the Pacific shore of the peninsula of Lower California, including both recent and Pliocene or Post-Pliocene species. Our Floridian correspondents, Messrs. G. W. Webster, J. J. White, and I. Greegor have generously remembered us with specimens representing species not previously received from them. They have thus added materially to the series representing the Floridian fauna. Mr. W. F. De Golier, of this city, also remembered us with a large case of West Florida shells, several of which were very acceptable additions, including a very fair specimen of *Voluta junonia* from near Tarpon Springs.

A valuable collection of Post-Pliocene types, illustrating the paper of Mr. R. E. Call on the fresh-water fossils of the Bonneville Lake Basin, Utah, was received from the U. S. Geological Survey. Dr. Sterki, who has been studying the smaller land-shells, also presented a series of types of these difficult little forms, while several additions were made by Mr. W. G. Binney to the Binney type collection of American land-shells. The last-named gentleman also presented 92 electrotypes of figures used by him in his supplements to previous publications on American land-shells. We also received from Dr. P. H. Carpenter, of the Biological Laboratory of Eton College, England, a series of 34 slides of sections of shells illustrating the classical memoir of the late Dr. William B. Carpenter on the Structure of the Shell in Mollusks and Brachiopods, the first series of which is in the British Museum.

### ROUTINE WORK.

The routine work of the year has been largely devoted to the general collection as distinguished from the faunal series upon which work has previously been concentrated. Last year ended with the arrangement of the east coast fauna of the United States, south from Cape Hatteras, and the West Indies, and the preparation of a preliminary catalogue of the fauna of the southeast coast of the United States, which was duly printed.

The old general collection has passed through many vicissitudes. The worst event in its history was its being mounted with a preparation of shellac, on glass plates or tablets. As there is no known cement which will remain hard and unite permanently two such surfaces as those of polished glass and shell in a climate subject to such extremes of temperature as ours, in the course of time all of these specimens had to be removed from the glass tablets, each and every shell defaced by a dark-colored patch of shellac. This was so serious an injury that when the general collection was taken up for reivsion, it was attempted, fortunately with success, to remove the shellac by the use of alcohol. This work was begun by Mr. Jouy and continued to its termination by Mr. Bond, and the worst result of the shellac now visible is a slight discoloration of some of the more porous specimens. The alcohol in which the shellac was soaked off was put to a good purpose and used for hardening sundry tertiary fossils which needed such an application for their proper preservation, and the general result of this work was very satisfactory.

A large part of the work of the past season has consisted in the segregation of previously labeled and registered material according to its biologic relations and its incorporation with the general collection. Over 1,200 trays containing about 75,000 specimens have been handled in this manner and are now in shape for arrangement in systematic order in the new cases just provided for them. Concurrently with this, a large number of old, dirty, or defective labels have been rewritten, specimens put in new or more suitable tubes or trays, or otherwise cleaned, revised and re-arranged.

This work has been conducted under the supervision and direction of Dr. Stearns, and at the same time many of the fine land-shells of the series presented by the late Dr. Isaac Lea have been arranged and administered upon. A large quantity of fine gravel and bottom stuff, the siftings from deep-water dredgings by the *Albatross* and other Fish Commission vessels, which is very rich in minute, rare, and singular forms, has been picked over. In this work Miss Beard has rendered excellent assistance. When it is understood that in a gallon of this material more than 1,000 specimens of 250 species have been found, of which fully half were unknown to science, it will be better understood how much of value is comprised in the result of this tedious picking over. This material is perfectly unique, and when studied is certain to add largely to our knowledge.

By no means an insignificant part of the work of the Department of Mollusks is comprised in the assistance given, through correspondence, to students all over the country. The writer has always regarded the work as one of the most imperative duties. However elementary the question asked, or tedious the furnishing of an answer has been, letters received are, so far as the ability of the force permits, promptly and courteously answered and the writers assisted, whether qualified naturalists or not, in any matter germane to the work of this department. From a purely selfish standpoint, also, the plan is to be recommended. It not only assists students to become men of science, but it increases the general interest in natural history and the favorable disposition of the public in its relations to science. If the Museum gives out valuable information and expends valuable time in the task, so, also, it frequently receives data of interest and importance, as well as specimens which enrich its collections. Lines of sympathy are established, focusing in the Museum, which extend all over the country, and which, we may be confident, materially aid in the "increase and diffusion of knowledge among men."

Having noticed in the newspapers that an excitement relative to fresh-water pearl-mussels prevailed in many parts of Wisconsin, Iowa, Illinois, and the Upper Mississippi drainage area, Dr. Stearns prepared a typewritten circular which was sent to various parties in the region, requesting specimens of mussels from which pearls had been obtained. In response to this, several parcels of shells were forwarded to the Museum and are now awaiting identification, after which Dr. Stearns will prepare a review of the subject with such comments as it may seem to require.

The collectors of the Department of Agriculture, under the direction of Dr. C. Hart Merriam, have forwarded several interesting packages of shells which have been studied by Dr. Stearns with the result of finding several new things. The manuscript relating to the latter is now in the hands of the printer. An allotment for making drawings of interesting or new forms of shells was granted at the beginning of the year, at the suggestion of the Assistant Secretary. Excellent use has been made of it, admirable drawings of many critical, little known, or unfigured species being now in our hands. These may be regarded as a beginning toward an iconography, which, it is to be hoped, may eventually include all our species.

The elimination of duplicates has proceeded *pari passu* with the revision of the general collection and the incorporation of new material. These duplicates have been in large part boxed, numbered, labeled, and stamped, so as to be in a state for storage until they can be distributed or put in sets for educational purposes, our force being entirely inadequate at present to any such undertaking. With the assistance of Mr. Greegor, a beginning has been made in sectioning and preparing for exhibition a certain number of large forms, so as to exhibit their internal formation or subsurface coloration.

A pathologic series has also been started by Dr. Stearns to exhibit the anomalies of structure occasionally presented by these animals.

## LIBRARY.

The donation of valuable books, germane to the study of mollusks, by the heirs of the late Dr. Isaac Lea, though doubtless referred to in the report of the Librarian, deserves special mention here, as also the donation by the Wagner Free Institute of Science, Philadelphia, of a nearly complete copy of Kiener's "Iconographie," a work totally absent from all libraries accessible in Washington, and containing some of the finest illustrations of shells ever published.

## SPECIAL RESEARCHES.

In section IV of the Report will be found the bibliographical notices of papers published by the curator, adjunct curator, and others interested in the conchological work of the Museum.

Work which has been carried on during the year and has not yet been printed may be summarized as follows: The curator has devoted a large proportion of his leisure to the examination and illustration of the tertiary fauna of Florida, especially that above the Eocene. The first half of the resulting monograph is now passing through the press.

The second part is fairly well advanced, but will require the writer's attention for some time to come.

In connection with this investigation the writer has studied, and offers an explanation of, the dynamic process by which the spiral parallel ridges of the interior of gastropod shells are produced and become amenable to the influence of natural selection. As one of the first demonstrations of dynamical evolutionary processes among mollusks, this paper, it is believed, will be of interest.

Dr. Stearns has been at work on the West American collections of the *Albatross* and on sundry interesting southern forms of land-shells, and has prepared for the ethnological department of the Museum a series of shells to illustrate his paper on "Primitive Money" (published in the Report, U. S. National Museum for 1886-'87), and also a series to illustrate the Indian game of "Ha" and the game of "Props," as described in the paper on that subject referred to in the Bibliography (section IV) of this Report.

Mr. Simpson has in view a revision of the Floridan *Unionidæ*.

## STATE OF THE COLLECTION.

In previous reports I have explained why it is impossible to give the exact number of species, specimens, duplicates, etc., contained in the collections under my charge. In my last report it was estimated that the collection contained about 468,000 specimens of all sorts, since which about 3,500 specimens have been received, which would make a total of about 471,500 specimens in the collection, of which perhaps one-quarter are preserved in alcohol.

The total number of entries in the Museum register or catalogue for 1888-'89 was 6,323; for the present year it was 6,569. The registration, with certain gaps, as exhibited in the following table, terminates with No. 116,920. The total number of registrations to date, omitting duplicate entries and vacant numbers assigned to Professor Verrill, but not yet reported as used by him, is 94,903, representing about 284,700 specimens. The number of workers requires the simultaneous use of several volumes of the register, which explains why the following table is necessary to show the registrations for the entire year.

*Entries in the registers*, 1889–'90.

| Volume. | From— | To - | Total. | Remarks. |
|---|---|---|---|---|
| XVIII | 87,512 | 87,760 | 248 | |
| XX | 97,300 | 97,462 | 162 | |
| XXI | 102,074 | 102,200 | 126 | Volume now filled. |
| XXII | 102,201 | 106,825 | 4,624 | Do. |
| XXIII | .......... | .......... | ....... | Reserved for Professor Verrill. |
| XXIV | 111,426 | 112,041 | 615 | Reserved for fossils. |
| XXV | 116,126 | 116,920 | 794 | |
| Total | .......... | .......... | 6,569 | |

## PERSONNEL.

The force of the Department of Mollusks has comprised, in addition to the honorary curator, the following-named assistants: Dr. R. E. C. Stearns, U. S. Geological Survey, adjunct curator; Mr. P. L. Jouy, aid, transferred in January, 1890, to another department; Mr. Charles Torrey Simpson, aid, in place of Mr. P. L. Jouy; Mr. S. Hazen Bond, skilled laborer; Miss M. A. Yeatman and Miss N. C. Beard.

# REPORT ON THE DEPARTMENT OF INSECTS IN THE U. S. NATIONAL MUSEUM, 1890.

By C. V. RILEY, *Honorary Curator.*

During the past fiscal year the increased space in the laboratory has afforded facilities for a proper display of the collections and for much work on the arrangement of the different orders and families into the systematic, biologic, and duplicate series.

The educational exhibit collection, which was reported on as completed in my last annual report, has been somewhat improved, and the economic collection, which was somewhat damaged during the return shipment from the Paris Exposition, has been overhauled and put in place again.

A large collection of illustrations of North American insects, prepared for the Paris Exposition, adds value to the exhibit collection. The illustrations represent wood-cuts and plates, mostly from the original drawings of the curator. These were carefully hand-proofed from the original blocks and present a unique series of cuts, many of which in rougher impression have become familiar to the American public through repetition in entomological and agricultural publications.

Many important accessions have been received during the year, of which the following may be mentioned:

A large collection of Myriapoda, containing about 2,200 specimens and numerous types, was purchased from the mother of the late C. H. Bollman, Bloomington, Indiana.

A collection of 125 rare Micro-Lepidoptera, containing types of a number of his species, was received from Lord Walsingham, England, through the curator.

Fourteen Old World species of blind Coleoptera, obtained by exchange from Prof. R. Gestro, Genoa, Italy. (22224.)

A collection of 2,500 species of Coleoptera, many of which were new to the Museum, was purchased from M. L. Linell, Aid to the Department. (22705.)

A well mounted series of Australian and New Zealand insects, collected by Mr. A. Koebele, containing about 400 species of Coleoptera, Hemiptera, Orthoptera and Lepidoptera, were received through the curator. Also through the same source, five boxes of Australian and New Zealand insects, collected by Mr. Koebele, including 29 different galls, and, in many cases, the insects bred from them; 42 Coccids, 415 Psyllids, and various other interesting specimens, especially Micro-Hymenoptera, all most carefully mounted. (22474.)

Types of many new species of North American Coleoptera have been received by exchange from Capt. T. L. Casey, New York.

One hundred and twenty species of Lepidoptera, collected by Dr. W. L. Abbott, between Zanzibar and Kilima-Njaro, East Africa. (23158.)

A collection of West and South African insects of various orders, made by Mr. W. H. Brown, naturalist to the United States Eclipse Expedition of 1889, was received. This contains 75 species of Coleoptera, 45 of Lepidoptera, 19 of Hemiptera, 25 of Hymenoptera, 7 of Diptera, 10 of Neuroptera, 46 of Orthoptera, 12 of Arachnida, and 10 of Myriapoda. (23272.)

A collection of 87 species of South African Coleoptera, some of them named, were received in exchange, from Mr. J. H. Brady, Cape Town. (23288.)

Four thousand six hundred specimens of well-mounted insects, largely Coleoptera, collected by Mr. A. Koebele, in California, were received through the curator. (23340.)

Types of several new species of North American Noctuidæ have been obtained by exchange, from Prof. J. B. Smith, New Brunswick, New Jersey.

The insect collection of the late Dr. Asa Fitch, purchased by the Agricultural Department, has been added to the general collection. Although considerably damaged, and, in part, ruined by neglect, this collection of New York's late eminent State entomologist still contains many important types and has a special value.

The routine work during the year has been:

(1) The making up of collections for exchange, among which are the following:

A small lot of blind American Coleoptera for Prof. R. Gestro, Genoa, Italy.

A small lot of Chrysididæ from Vicomte R. du Buysson, Bron-Vernet, France.

A collection of 87 species of North American Coleoptera for Mr. J. H. Brady, Cape Town.

(2) The naming of specimens for collectors.

As examples of work of this kind, may be mentioned the naming of a miscellaneous lot of insects for Mrs. R. W. Summers, San Luis Obispo, California; several lots of Coleoptera for Mr. W. D. Richardson, Fredericksburg, Virginia; a collection of Coleoptera and Lepidoptera for Prof. L. Bruner, Lincoln, Nebraska; a collection of Mexican insects of different orders for Prof. A. Dugès, Guanajuato, Mexico; Coleoptera for Mr. O. Dietz, New York; for Prof. H. Osborn, Ames, Iowa, and for Mr. J. D. Sherman, Peekskill, New York. In addition a full duplicate and named series of Hemiptera has been prepared and sent to Prof. A. J. Cook for the Michigan Agricultural College.

(3) The selection of material to be sent to specialists for study and determination.

The Coleoptera of the tribe Blapstini, and the genera Eurymetopon and Emmenatus, were sent to Capt. T. L. Casey, New York, who is working upon these groups.

(4) The work of arranging in permanent shape all the collections.

The arrangement of the North American Coleoptera, mentioned in the last annual report as having been commenced, has been completed. The systematic series occupies 323 boxes, and contains 5,900 properly identified species and 440 undetermined and undescribed species. The biologic series occupies 30 boxes and illustrates the life-history of 630 species. The duplicate series of 1,850 species has been arranged in 116 double boxes, and this material is now available for exchange or distribution, and is very rich in specimens.

The Hemiptera-Heteroptera have been rearranged according to Uhler's check list. The collection contains 455 named species from the United States, and occupies 53 boxes. Of duplicates, there are 138 species in 14 double boxes. In addition, there are 160 named exotic species in 5 boxes.

(5) The actual care of the collection.

The entire collection was gone over twice during the past year and the naphthaline cones renewed where necessary.

In the annual report for 1888–'89 a full list of the special researches then in progress and based upon museum material was given. Of the work there mentioned, that of Mr. W. H. Ashmead upon the Ichneumonidæ of the National Museum Collection has since been published as No. 779 of the extras from the Proceedings of the National Museum. Mr. L. O. Howard's "Annotated Catalogue of the Insects Collected in 1887–'88" has been published as extra No. 771. Mr. John B. Smith's "Contributions towards a Monograph of the Noctuidæ of Temperate North America—Revision of some Tæniocampid Genera" has been published as No. 781.

Mr. Lawrence Bruner's "New North American Acrididæ found North of the Mexican Boundary," is now published as No. 764.

During the past year, by a rough estimate, some 15,000 specimens have been added to the collection. Until the work of re-arrangement has been completed it will be very difficult to draw up a tabulated statement of the exact condition of the collection as a whole. It is safe to say that more than 30,000 specimens of the different orders have been added since the publication of the rough tabulated statement in the annual report of the curator for 1886–'87.

The last catalogue entry for June, 1889, is 483; and for June, 1890, 572.

# REPORT ON THE DEPARTMENT OF MARINE INVERTEBRATES IN THE U. S. NATIONAL MUSEUM, 1890.

By RICHARD RATHBUN, *Honorary Curator.*

The curator is able to report increased activity in his Department during the past year, resulting chiefly from the appointment of an assistant curator, whose time belongs exclusively to the Museum. Mr. James E. Benedict, who was assigned to this position in January last, is especially well qualified for the duties of the office, having served for several years as chief naturalist on the Fish Commission steamer *Albatross.* He is best known as an authority on marine annelids, but since he entered the service of the Museum he has turned his attention to the higher groups of crustaceans, on which he has already accomplished much original work. The exhibition hall remains as it was a year ago, except for the addition of several storage-cases, which will serve as the bases for display cases as soon as the alterations to the west hall have been completed. The gallery in the main hall belonging to this department has been transformed, so far as possible, into a convenient laboratory, where the overhauling of collections is principally carried on. The department is, however, still cramped for storage-room for both dried and alcoholic specimens, and consequently the working space is altogether too small. The west basement room has been set apart for the arrangement of alcoholic type collections for convenience in making identifications, and several of the larger groups are now represented there. The general alcoholic collections in the main storage-room have been maintained in good condition, and the same can be said of all the material in the charge of this department. The accessions have been greater in number and of more importance than during 1888–'89, but the amount of material received has been much less than when the Fish Commission collections were transferred directly to the Museum from the steamers and other field parties.

There has been the customary amount of cleaning, replenishing of alcohol, sorting of collections, labeling, and cataloguing, as described further on. The assistant curator has several reports in progress based upon his studies of the crustacea, and some of the recent additions among the echinoderms have been examined by the curator. There are several collaborators, outside of the Museum staff, at work upon our collections, and to them a small amount of material has been furnished during the year. The distribution of duplicate series No. IV has been continued, and a number of special duplicate sets have been supplied to institutions and individuals. The principal explorations to be noted from which collections have been received or may be expected at an early date are those of the Fish Commission steamer *Albatross* in the North Pacific Ocean, and the Eclipse Expedition to West Africa.

As the curator has been prevented from giving much personal attention to the department outside of the necessary correspondence, the burden of the work has devolved upon his two assistants, Mr. James E. Benedict and Miss M. J. Rathbun, to whom is due the entire credit for the excellent condition of its affairs.

The total number of accessions received by this department during the year was 27, in addition to which three small lots of specimens were referred to it for examination and report. Two collections have been transferred by the U. S. Fish Commission: a series of echini from the Pacific coast, and one of crayfishes from several sources. The former consists of the shore and shallow-water echini obtained by the steamer *Albatross* during her investigations in the North Pacific Ocean between July 1, 1888, and January 1, 1890, and contains 15 species and 232 specimens, representing many localities between Bering Sea and Mexico. The deep-water forms from the same region are being studied by Mr. Alexander Agassiz, and a type series will eventually be presented to the Museum. The second accession comprises 10 species and 115 specimens of crayfishes, obtained during the inland investigations of the Fish Commission in 1888, chiefly under the direction of Dr. David S. Jordan, in the States of Virginia, North Carolina, Tennessee, Michigan, and Indiana. They have been identified by Prof. Walter Faxon, of the Museum of Comparative Zoölogy, Cambridge, Massachusetts.

To the Rev. A. M. Norman, of Burnmoor Rectory, Fence Houses, Durham, England, we are indebted for a very valuable series of European marine invertebrates, chiefly from the Mediterranean Sea, comprising 42 species of echinoderms and 57 of crustaceans, many of which are new to our collection. Another important contribution from Europe has been received from Dr. P. Herbert Carpenter, of Eton College, Windsor, England. It consists of 29 microscopical mountings of foraminifera, obtained during the exploration of the British ships *Porcupine*, *Valorous*, *Lightning*, and *Challenger*, and prepared and determined by the late Dr. William B. Carpenter, whose published researches upon this low group of animals are widely known.

Other accessions deserving of special notice are the following: From Wesleyan College, Middletown, Connecticut, 23 species of Bermuda annelids, collected in 1876 and 1877 by Dr. G. Brown Goode, and described by Dr. H. E. Webster, president of Union College. From the United States Eclipse Expedition of 1889-'90 to West Africa, William Harvey Brown, naturalist, a miscellaneous collection consisting chiefly of crustaceans, annelids, echinoderms, actinians, and sponges, from the Azores, Cape Verde Islands, Ascension Island, St. Helena, Barbados, and the west coast of Africa. From the Bureau of Navigation, Navy Department, 25 specimens of deep-sea soundings taken in the North Atlantic Ocean by the U. S. S. *Dolphin*, Commander George F. F. Wilde, U. S. Navy, commanding, during the passage from the Straits of Gibraltar to New York. From Prof. O. B. Johnson, University of Washington, Seattle, Washington, a miscellaneous assortment of crustaceans, tunicates, echinoderms, and pennatulæ, from Puget Sound. From Mr. Romyn Hitchcock and Mr. H. Loomis, collections of crustaceans, echinoderms, corals, and sponges, obtained in Japan.

In view of the proposed repairs to the west hall of the Smithsonian institution, it has been considered inexpedient to make any extensive changes in the exhibition collection of marine invertebrates which is there displayed. Plans have been partly perfected, however, for the formation of a synoptical collection, and the enlargement and rearrangement of the present general one. In anticipation of these additions, Mr. Benedict has begun the preparation of a series of dried crustaceans. He has also made many microscopical mountings of crustacean appendages for study purposes.

Eight additional mahogany unit cases have been placed in the west hall, affording much desired space for the storage of dried echinoderms and corals. Four of the old style table cases have also been transferred to the gallery in the main hall, where they are used for holding the dried collection of crabs and many of the duplicate specimens. The unit trays stacked in the same gallery have all been furnished with metal label-holders, which have proved a great convenience. The arrangement of a type series of alcoholic specimens in the small west basement room, for convenience in identifying collections as they are received, has been continued, the groups now represented there being the brachyurans, echini, and ophiurans. The card-catalogues of those groups have also been brought down to date. This readjustment of the collections was rendered expedient on account of the imperfect lighting of the general alcoholic store-room.

The alcoholic collection of alcyonarians and actinians, and the entire collection of brachyurans and anomourans have been carefully gone over, the jars cleaned, the alcohol and labels replaced where necessary, and the card-catalogue of the same revised and completed. In the overhauling it was found that the dried crustaceans had suffered somewhat from the attacks of insects. This collection was, therefore, thoroughly renovated and newly poisoned, but as none of our storage-cases are provided with the proper safeguards against these pests, it is impossible to prevent injury of this character from time to time. The assorting of Mr. William H. Dall's Alaskan collection, some parts of which received attention in previous years, has been entirely finished, and all of the brachyuran crustaceans in the Department have also been separated as to species in the course of Mr. Benedict's studies of that group. The large collection of samples from the ocean-bottom, comprising those obtained by the Fish Commission and by other government surveys, has been overhauled and catalogued, and the packages containing them have been labeled on the outside for convenience of reference.

Mr. Benedict has returned to the Museum several hundred vials of annelids which were referred to him several years ago for study, and also a large series of microscopic preparations of the appendages of the same species. Much time has been spent in making up the several special sets of duplicates for distribution which are described below.

The amount of cataloguing done during the year is explained in the following table:

| Group. | Entries to June 30, 1889. | Entries to June 30, 1890. | No. of entries made during year. |
|---|---|---|---|
| Crustaceans | 14, 385 | 14, 934 | 549 |
| Worms | 4, 728 | 4, 810 | 82 |
| Bryozoans and Ascidians | 2, 778 | 2, 844 | 66 |
| Echinoderms and Cœlenterates | 16, 885 | 17, 459 | 574 |
| Sponges and Protozoans | 6, 056 | 6, 287 | 231 |
| Total | | | 1, 502 |

During the past year the curator has identified the shore and shallow-water echini collected by the steamer *Albatross* on the west coast of North America in 1888 and 1889, and a type series of the same has been deposited in the Museum. The deep-water echini from the same source have been referred to Mr. Alexander Agassiz, of Cambridge, Massachusetts. The curator has also begun the classification of the star-fishes from the North Pacific Ocean, making use of the large collection that has gradually accumulated in the Museum, together with that recently obtained by the steamer *Albatross.*

The assistant curator, Mr. Benedict, has paid most attention to the brachyuran and anomouran crustaceans, with which this department is well supplied, having completed the determinations in several groups belonging to the Atlantic coast, and made considerable progress with those from the North Pacific Ocean. The collection from the latter region is especially rich in the number of specimens and species which it contains, the field being a comparatively new one, brought into prominence by the recent investigations of the steamer *Albatross.* Reports upon these studies are in course of preparation. Mr. Benedict has also reported upon the crustaceans collected by the United States Eclipse Expedition to West Africa, comprising 18 species of brachyurans, 4 of anomourans, 4 of macrurans, 3 of isopods, and 1 of branchiopods, and has done some work upon the Alaskan annelids obtained by Mr. Dall and the Fish Commission.

Prof. Walter Faxon, of the Museum of Comparative Zoology, Cambridge, Massachusetts, has finished his studies upon the cray-fishes sent him by this department in April, 1889, and upon those supplied by the Fish Commission, chiefly from the collections made by Dr. David S. Jordan and Mr. C. H. Bollman, in Virginia, North Carolina, and Michigan, during 1888. The specimens from both sources have been returned, and Professor Faxon's report has recently been printed in the Proceedings of the Museum. Prof. Edwin Linton, of Washington and Jefferson College, Pennsylvania, has continued his investigations upon the entozoan parasites of fishes, and additional material was sent to him in June, including a collection referred to Dr. A. S. Packard several years ago, but not studied by him. The reports of Professor Linton, having a direct bearing upon the work of the Fish Commission have appeared in its publications.

Mr. W. C. Kendall, of the Fish Commission, was given the facilities of the department during last spring to enable him to identify the brachyuran crustaceans collected on the west coast of Florida in 1889 by the schooner *Grampus*. Miss Southworth, of the Department of Agriculture, was also afforded accommodations in the laboratory, during about three months of the winter, for carrying on special researches in zoölogy, and we are indebted to her for assistance rendered Mr. Benedict in his examination of the crustacea.

The following additional material has been supplied to specialists outside of the Museum, for study and report: To Prof. F. H. Herrick, Adelbert College, Cleveland, Ohio, the entire collection of Alphei, comprising 49 lots of specimens. To Prof. C. S. Dolley, University of Pennsylvania, Philadelphia, Pennsylvania, the entire collection of crustaceans from the Bahama Islands. To the Rev. Albert Mann, jr., Newark, New Jersey, a number of samples of ocean bottom, to be examined for diatoms.

Series No. IV, of duplicate marine invertebrates, the composition of which has been described in previous reports, has been distributed to seventeen institutions. Each set contains about 110 species, collected during the investigations of the U. S. Fish Commission on the Atlantic coast of the United States. They have been prepared with the special view of aiding teachers in their class-work in natural history, and as most of the groups which they represent are difficult to obtain, particularly for the inland schools and colleges, they have been in great demand for educational purposes.

The institutions supplied during the past year are as follows, namely: Clark University, Worcester, Massachusetts; Lawrence University, Appleton, Wisconsin; University of South Carolina, Columbia, South Carolina; Ottawa University, Ottawa, Kansas; Muhlenberg College, Allentown, Pennsylvania; University of Wisconsin, Madison, Wisconsin; High School, Council Bluffs, Iowa; New Orleans University, New Orleans, Louisiana; Woman's College, Baltimore, Maryland; Public

Schools, Olean, New York; Museum of the State Agricultural College, Corvallis, Oregon; South Jersey Institute, Bridgeton, New Jersey; Dakota University, Mitchell, South Dakota; Massachusetts Agricultural College, Amherst, Massachusetts; Nebraska Institution for the Deaf and Dumb, Omaha, Nebraska; St. John's College, Annapolis, Maryland; Syrian College, Beirut, Syria.

In 1883, ten special sets of duplicate marine invertebrates, also selected from the collections of the U. S. Fish Commission, were prepared in connection with the American exhibit for the Great London Fisheries Exhibition of that year. They contained about 200 species each, and were intended for distribution to foreign institutions, in illustration of the natural history investigations of the Fish Commission. Six of those sets were disposed of at that time. Two of the remaining sets have been sent this year to the British Museum, London, and the K. K. Naturhistorisches Hofmuseum, Vienna.

Other special sets of marine invertebrates have been supplied as follows: The Rev. A. M. Norman, England, in exchange, 62 species, chiefly brachyuran crustaceans and echinoderms from the deep-sea dredgings of the steamer *Albatross*. Tuft's College, Medford, Massachusetts, 105 species, and 12 lots of unassorted foraminifera. The Icelandic Society of Natural History, Reykjavik, Iceland, 133 species from the North Atlantic and North Pacific oceans. Oberlin College, Oberlin, Ohio, 75 species. Academy of Natural Sciences, Philadelphia, Pennsylvania, 120 species. Wagner Free Institute, Philadelphia, Pennsylvania, 88 species. Cincinnati Society of Natural History, Cincinnati, Ohio, 92 species. Central Illinois Scientific Society, Virginia, Illinois, 96 species. Western Normal College, Shenandoah, Iowa, 76 species. John W. Spencer, Paxton, Indiana, in exchange, 14 species of West Indian corals.

Nine smaller collections, containing only a few species each, or consisting of several lots of unassorted foraminifera for microscopical study, have been sent to as many individuals and institutions.

Important investigations have been carried on by the Fish Commission during the past year, from which this and other departments of the Museum may expect to derive substantial benefits before long. The steamer *Albatross* left San Francisco, May 21, 1889, on her second northern cruise, which was confined mainly to the coasts of Oregon and Washington. One trip extended as far north, however, as Sitka and Juneau, Alaska, and a start was also made for Bering Sea, but, through an accident to the machinery, this longer cruise had to be abandoned. Soundings, dredgings, and fishing trials were carried down the coast from the Straits of Fuca to Cape Mendocino, California, this work terminating in the fall of 1889. During March and April, 1890, the region between Point Conception, south of San Francisco, and Punta Arena, north of San Francisco, was subjected to the same careful examination, and on May 4 the *Albatross* left for Bering Sea where she is expected to remain during the entire summer. During the fiscal year up to May 4, 1890, 133 dredge-hauls were made, in depths of 7 to 552 fathoms (station numbers 3077–3209). The zoölogical collections obtained are now at the Fish Commission laboratory in Washington.

The steamer *Fish Hawk* was engaged in scientific inquiries only from July to October, 1889, during which time she was at work upon the oyster grounds of Long Island Sound, between South Norwalk and New Haven. This survey was conducted chiefly for the purpose of ascertaining the characteristics and condition of the grounds, and of determining means of lessening the ravages of the natural enemies of the oyster. The natural history of the region being comparatively well known, only a few specimens were saved from the dredgings. The schooner *Grampus* was occupied during the summer of 1889 in making a survey of the mackerel region south of New England, under the direction of Prof. William Libbey, jr., of the College of New Jersey. The area examined had a width of about 70 miles, and extended seaward a distance of about 130 miles from the coast, or well into the Gulf Stream. The work was principally of a physical character, having reference to temperature, densities, currents, etc., but important collections of surface-animals were made, and a part of these are now being studied by Prof. W. K. Brooks, of John Hopkins University.

Another branch of inquiry that has grown up within the past two years has been the systematic investigation of the interior lakes and rivers. This work has been carried on mainly under the direction of Dr. David S. Jordan, and in the interest of fish-culture and the fisheries. Large collections of fishes have been made, and attention has also been paid to the aquatic invertebrates, especially the crayfishes. During the year just ended the investigations have extended to the following States and Territories: Georgia, Alabama, Louisiana, Ohio, West Virginia, Indiana, Iowa, Missouri, Arkansas, Colorado, Utah, the Yellowstone Park, and Kadiak, Alaska.

# REPORT ON THE DEPARTMENT OF COMPARATIVE ANATOMY IN THE U. S. NATIONAL MUSEUM, 1890.

By FREDERICK W. TRUE, *Acting Curator.*

The fiscal year to be covered by this report was not a very favorable one for the department. The acting curator was too much engrossed by his duties as the head of another department to do more than to oversee in a general way the operations carried on; while the assistant curator, who serves also as a preparator, was called upon to do considerable work in connection with the installation of vertebrate fossils and domestic animals, and also to prepare certain scientific articles for the report of the Museum.

The work done during the year was chiefly in the direction of perfecting the exhibition series and the study series of osteological specimens, and caring for material received in a fresh condition. In this connection the birds received the greatest share of attention. No attempt was made to obtain or exhibit any preparations of soft parts, owing to the lack of the necessary facilities and assistance.

Aside from the skulls belonging to skins in the Department of Mammals, there were few important accessions of osteological specimens of mammals. A skull of the South American Otter, *Lutra felina*, was received from the British Museum. A skeleton of a common Armadillo was purchased. The skeleton of a Black Bear which died in the National Zoölogical Park was added to the collection. Reference to the skulls belonging to skins in the Department of Mammals will be found in the report of that department.

An important series of birds in alcohol was collected by the United States Astronomical Expedition to Angola, Africa. This material has not yet been identified or entered. Skeletons of two adult Hoatzins, *Opisthocomus cristatus*, and those of five young individuals were received from the Demerara Museum. Skeletons of the King Penguin, *Aptenodytes forsteri*, and of the Little Penguin, *Eudyptila minor*, were purchased. An extensive series of North American water-fowl in alcohol was presented by Mr. G. Frean Morcom through Dr. R. W. Shufeldt. Dr. Shufeldt also presented a large number of birds in alcohol, principally of species inhabiting western North America.

An important reptilian skeleton was that of the Abingdon Island tortoise, *Testudo abingdoni.* It is believed to be the only one preserved in any museum. A skull of Schlegel's Crocodile, *Tomistoma schlegeli*, was purchased.

No fishes were entered during the year.

The changes in the exhibition hall during the year were not such as to affect materially its general appearance. A marked improvement was the addition of order and family labels throughout the entire exhibition series.

It was found expedient to place casters under all the smaller cases, which action, however, made it necessary to twice move all the smaller specimens in the hall.

Sixty-five entire or partial skeletons of vertebrates were added to the exhibition series during the year. Of these, 40 were mammals, 16 birds, 8 reptiles and batrachians, and 2 fishes. In addition, the preparators cleaned 96 osteological pieces. The work done for the Department of Agriculture is mentioned in the report of the Department of Mammals.

The entries of osteological material in the several classes were as follows:

| | |
|---|---|
| Mammals | *1,961 |
| Birds | 236 |
| Reptiles and batrachians | 29 |

The first and last numbers for the year in the several catalogues are as follows:

| Class. | First number, July, 1889. | Last number, June, 1890. |
|---|---|---|
| Mammals | 23782 to 25651 | |
| | 25751 to 25811 | |
| | 30026 to ....... | 30055 |
| Birds | 18508 | 18743 |
| Reptiles and batrachians | 29262 | 29290 |
| Fishes | ................... | *26084 |

* September 11, 1888.

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*All but a small number of these entries were those of skulls belonging to skins in the Department of Mammals, or in the U. S. Department of Agriculture deposit.

# REPORT ON THE DEPARTMENT OF PALEOZOIC FOSSILS IN THE U. S. NATIONAL MUSEUM, 1890.

By CHARLES D. WALCOTT, *Honorary Curator.*

During the first seven months of the year Dr. R. R. Gurley was employed in labeling the collections for the exhibition and students' series in the southeast court; in making a special study upon American graptolites; and in looking after the painting of the catalogue numbers, by an assistant, on the specimens being transferred from the laboratory to the court. Dr. Gurley's study of the graptolites has resulted in the identification and labeling of the species in the collection of the Museum, and he has made a valuable contribution to the study of the graptolitidæ. He resigned his position on the Museum force in March to join the Fish Commission. Since his resignation, however, he has given all his spare time to the completion of a bibliography of the literature referring to the graptolites, and has also continued his general investigations upon the group.

In May Prof. Joseph F. James rearranged and put into shape the fossils from the Cincinnati formation of Ohio, contained in one of the exhibition cases. Attention was also given to the exhibition series of crustaceans from the Water-lime formation of New York; and the collection from the Chazy horizon of New York and Vermont was relabeled and, with much additional material, put on exhibition.

After returning, in October, from field-work in connection with the Geological Survey, my attention was given to the selection of material for the illustration of the Middle Cambrian fauna and to the study of the literature of the Cambrian rocks of America. These, in connection with the routine work demanding my attention as a member of the Geological Survey and as an honorary curator of the National Museum, so occupied my time as to prevent personal work on the exhibition series.

The work accomplished will, however, in the future, enable me to add to the value of the collections of the Museum. Several thousand beautiful fossils from the Lower Paleozoic rocks of New York and Vermont were collected under my direction for the Geological Survey. A beautiful series of trilobites from this collection has been placed temporarily in the exhibition cases, awaiting their transfer from the Geological Survey to the National Museum, when the study upon them shall have been completed.

The small amount allotted for the purchase of material for the exhibition series was of great assistance, and I respectfully repeat the recommendation urged in my last annual report, that a sum be reserved annually for increasing the Museum collections by the purchase of small collections of typical specimens that can not be obtained in any other way.

A detailed list of the accessions for the year will be found in section V. Notices of the papers published by those connected with this department will be found in the bibliography, section IV of the report.

The amount of material representing the collections was increased by the addition of 1,229 specimens, embracing 180 genera, 239 species, and 5 varieties.

The catalogue numbers taken up during the year were from 18431 to 23842, both inclusive.

The more important accessions received during the year are:

No. 22580: This accession, from the British Museum, includes a number of very beautiful specimens of trilobites, represented by 57 specimens, carrying 27 genera, 33 species, and 1 variety. It will be of service to students in comparing American with European species and genera.

No. 22730: This accession contains 66 specimens, giving 11 genera, 12 species, and 1 variety, from the Lower Cambrian; but the principal interest is centered in the 45 genera, 72 species, and 2 varieties, as furnished by the 526 specimens from the Hudson terrane of central New York, which have been placed on exhibition in the southeast court. This collection is one of the most complete of any that is known to me from this terrane in the State of New York.

No. 22847: A valuable addition from the Hudson terrane (Maquoketa shale) of Iowa. It includes 178 specimens, holding 19 genera, 25 species, and 1 variety, and affords the means of comparison between the fauna of the Hudson terrane in New York, Ohio, and Iowa.

There are two other accessions that properly should be credited to this year, but owing to the papers not having yet been completed in relation to them, they will be included with those of the next fiscal year. The material contained in them is from the Utica shale of central New York, and from the Eurypterus beds of the Water-lime formation of western New York.

*Recapitulation of accessions received during the year.*

| Accession number. | No. of genera. | No. of species. | No. of varieties. | No. of specimens. | Accession number. | No. of genera. | No. of species. | No. of varieties. | No. of specimens. |
|---|---|---|---|---|---|---|---|---|---|
| 22285 | 6 | 7 | ......... | 49 | 22681 | 1 | 1 | ......... | 1 |
| 22407 | 2 | 2 | ......... | 3 | 22712 | 1 | 1 | ......... | 1 |
| 22410 | 1 | 1 | ......... | 1 | 22730 | 56 | 91 | 3 | 592 |
| 22442 | 1 | 1 | ......... | 2 | 22740 | 3 | 3 | ......... | 3 |
| 22443 | 1 | 1 | ......... | 15 | 22776 | 9 | 11 | ......... | 36 |
| 22444 | 4 | 4 | ......... | 11 | 22788 | (*) | (*) | ......... | 41 |
| 22445 | 3 | 3 | ......... | 1 | 22839 | 3 | 3 | ......... | 8 |
| 22446 | 1 | 1 | (Slab) | 1 | 22847 | 24 | 31 | 1 | 287 |
| 22482 | 1 | 1 | ......... | 1 | 23119 | 2 | 2 | ......... | 2 |
| 22570 | 3 | 3 | ......... | 3 | 23120 | 3 | 3 | ......... | 3 |
| 22579 | 1 | 1 | ......... | 1 | 23121 | 1 | 1 | ......... | 1 |
| 22580 | 27 | 33 | 1 | 57 | 23137 | 2 | 2 | ......... | 8 |
| 22602 | 9 | 14 | ......... | 50 | 23138 | 3 | 3 | ......... | 12 |
| 22609 | 7 | 8 | ......... | 26 | 23156 | 1 | 1 | ......... | 1 |
| 22669 | 4 | 6 | ......... | 12 |  | 180 | 239 | 5 | 1,229 |

* Miscellaneous Brachiopoda.

# REPORT ON THE DEPARTMENT OF MESOZOIC FOSSILS IN THE U. S. NATIONAL MUSEUM, 1890.

By C. A. WHITE, *Honorary Curator.*

The honorary curator, and both of his assistants, Mr. T. W. Stanton and Mr. C. B. Boyle, being officially connected with the U. S. Geological Survey, it has not been practicable to devote more than a small part of the past year to work directly pertaining to the Museum. The usual routine work, however, such as the identification of accessions and reporting upon the same, has been done as occasion required. Much work has also been done upon collections of fossils brought to the Museum by members of the U. S. Geological Survey, which will place that material in an almost immediately available condition when it is officially turned over to the Museum.

Besides the material collected by the U. S. Geological Survey which has not yet been officially transferred to the Museum, only eight accessions were received during the year. These accessions were of comparatively little value as Museum specimens, but reports upon them were made to the Director of the Museum, and the usual disposition made of the material.

The work on the arrangement of the collections has been limited mostly to the exhibition series, which has been properly classified and systematically arranged. The exhibition series has frequently been consulted by students and investigators, and every proper facility has been granted such persons to aid them in their work.

The official work done by the honorary curator of this department for the U. S. Geological Survey, has been based largely upon the material in the Museum collections, but no special publications of its results have been made during the past year. Several papers relating to the work of the curator as an officer of the Geological Survey are now nearly ready for the printer.

No accurate statement can at present be given as to the total number of specimens in the collection, nor of the number in the reserve, exhibition, or duplicate series. No entries were made in the catalogue during the year, owing to pressure of other work.

A considerable amount of material, mostly fossils collected by members of the U. S. Geological Survey, is now in my charge at the Museum, and ready to be recorded in the Museum registers and officially turned over to its keeping. On account of the lack of any Museum assistant this work has been impracticable, and can not be undertaken until some one is detailed by the Museum for this work.

I have, during the past year, published two papers, both of which have a direct bearing upon my official work. These are mentioned in the Bibliography.

# REPORT ON THE DEPARTMENT OF BOTANY IN THE U. S. NATIONAL MUSEUM, 1890.

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By Dr. GEORGE VASEY, *Honorary Curator.*

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The report now presented constitutes my second annual report concerning the National Herbarium.

For want of time a precise statement of the number of species and specimens contained must be deferred for a future report, as the mere counting of the specimens would require the services of one person for about a month; only an estimate, therefore, will be given.

The National Herbarium consists of two parts, the larger of which has been in the custody of the U. S. Department of Agriculture since 1869; the other, established in 1885, now in the custody of the Department of Fossil Plants of the U. S. National Museum. The Museum employs no assistant curator or laborers in the Herbarium, all the force being provided by the establishments who use the collections.

A historical account of the collection at the Department of Agriculture was published in 1886,[*] and of the collection in the National Museum in the previous reports of the Department of Recent Plants in the Museum.

## SAFETY OF THE HERBARIUM.

The need of fireproof and commodious quarters is becoming year by year more pressing. The portion at the Department of Agriculture is especially in a condition to cause the greatest apprehension. If it were destroyed by fire, it could never be entirely replaced and a large number of type specimens would be lost. The collection of American grasses is the largest in existence and contains the type specimens of nearly all the species of American grasses described during the last fifteen years. It is unnecessary to go into detail concerning the value of the Herbarium, but a resolution passed in general assembly by the American Association for the Advancement of Science at its last meeting, calling the attention of the Secretary of the Smithsonian Institution and of the Secretary of Agriculture to the present insecurity of the Herbarium, and expressing an earnest desire that means be taken to properly care for it, shows the feeling of the scientific world in general in regard to the matter.

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[*] The Botanical Gazette, XI, pp. 153-156.

## ACCESSIONS.

The accessions to the Herbarium are received in part through the National Museum, but mostly through the Department of Agriculture. The total number for the year is 370. Of these, 24 came through the National Museum. Following are some of the more important accessions:

A set of 550 species of Japanese plants from S. Tegima, Director of the Educational Museum, Tokio, Japan.

A set of 335 species collected in Mexico by C. G. Pringle.

About 1,800 specimens of south Californian plants, many of them duplicates, from C. R. Orcutt, San Diego, California.

A set of 80 species of Canadian grasses from John Macoun, Geological and Natural History Survey of Canada.

Texan plants (2,817 specimens) collected by G. C. Nealley, of Houston, Texas.

A collection of about 900 specimens of east Floridan plants from J. H. Simpson, Manatee, Florida.

A collection of about 4,000 specimens made by Edward Palmer in Lower California and western Mexico.

Californian and Mexican plants from the California Academy of Science (327 specimens).

The first 135 species of a set of Bolivian plants collected by Miguel Bang.

About 100 Pacific slope species, many of them new, from E. L. Greene, Berkeley, California.

A set of 142 species of the Hepaticæ Cubenses Wrightianæ from the Harvard University Herbarium.

About 500 specimens from the U. S. Eclipse Expedition to Africa.

European mosses from Dr. I. Hagen, Trondhjem, Norway (320 species).

About 800 specimens collected by Frederick V. Coville in Virginia and North Carolina.

Many of the accessions were single specimens, or a few specimens sent for identification merely, and not prepared for the Herbarium. While the number of such accessions is considerable, the proportion of the specimens contained in them to all those received is small. The total number of specimens received in accession is 21,346.*

## HERBARIUM AT THE DEPARTMENT OF AGRICULTURE.

The Herbarium specimens received are disposed in two places, the herbarium proper and the duplicate herbarium. The latter is used as an exchange stock, which is very valuable in transactions with foreign botanists.

The force employed in mounting and labeling specimens is able to perform the amount of work at present required, while the number engaged in identifying plants has been increased during the last few months, so that there appears to be no immediate pressing need for additional assistants.

The number of specimens mounted is estimated to be about 125,000; in the duplicate herbarium, about 15,000; and of those not yet examined, about 10,000. About 6,000 specimens have been mounted during the year.

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* Single packages or single accessions were in some cases estimated, not counted.

### HERBARIUM AT THE NATIONAL MUSEUM.

The number of mounted specimens is estimated at 30,000; of duplicates, 3,000.

### ESTIMATE OF SPECIMENS.

The total number of specimens in the National Herbarium is therefore estimated as follows: mounted, 155,000; duplicates, 18,000.

A list of botanical papers published by the curator and by other collaborators will be found in the Bibliography (section IV).

# REPORT ON THE DEPARTMENT OF MINERALS IN THE U. S. NATIONAL MUSEUM, 1890.

By F. W. CLARKE, *Honorary Curator.*

During the year gratifying progress has been made in the Department of Minerals. The main collection has been carefully culled and, in great measure, re-arranged, and a new installation of the gem series is well under way. The Lea collection of micas is now exhibited in three table-cases, making a fine appearance; and the large wall-case which it formerly occupied is now filled with large mineral specimens which could not previously be displayed. Two hundred duplicate sets, of fifty-seven specimens each, have been prepared for distribution to schools and colleges; and eleven special series of duplicates have been sent out in exchange for material received.

The more important accessions have been: by gift, from W. G. Clark and G. M. Wilson, of Mullan, Idaho, a remarkable series of plattnerite and pyromorphite from the Coeur d'Alêne district; from J. A. Lucas, Silver City, New Mexico, 337 pseudomorphs of copper after azurite; from G. D. Hamill, Georgetown, New Mexico, 51 specimens of descloizite and vanadinite; Mr. Alex. McGregor, of the same place, also gave 110 specimens of the same mineral, forming a unique series as regards beauty and completeness; from W. P. Jenney, U. S. Geological Survey, one specimen of native lead from Idaho; from Dr. R. H. Lamborn, of New York, eight cut stones for the gem collection; from Ira R. Allen, Fairhaven, Vermont, two barrels of amazonstone from Amelia Court-House, Virginia; from the Pennsylvania Salt Company, one barrel of cryolite from Greenland; from Dr. H. S. Lucas, Cullasaja, North Carolina, 316 specimens of minerals from Corundum Hill; from Mrs. Hulda Burdick, Pine Mountain, Georgia, 204 specimens of minerals from the Laurel Creek corundum mines. From the U. S. Geological Survey, a large series of minerals from the lead and zinc mines of southwestern Missouri and northwestern Arkansas, collected by W. P. Jenney; also a superb series of vanadinite, dumortierite, and other Arizona minerals, collected by Dr. W. F. Hillebrand. Large field collections were also made by Mr. W. S. Yeates, assistant curator, in Virginia and North Carolina, and some material was collected by myself in the iron region near Lake Champlain.

By purchase, many fine specimens have been added to the collection. From J. W. Beath, 36 cut stones were obtained for the gem-series; from W. B. Smith, nearly 100 specimens of choice Colorado minerals; and 51 miscellaneous specimens were bought from G. L. English and Company. Through Dr. Hillebrand, a series of scarlet vanadinite from the Silver District, Arizona, was purchased of a local miner, forming the most superb series of that species in existence. Satisfactory exchanges have also been effected with the British Museum, the Museum at Stockholm, Mr. Ira B. Allen, Mr. C. W. Kesler of Statesville, North Carolina, Mr. George Vaux, jr. of Philadelphia, and others.

The collection of meteorites has been increased by ten falls. Prof. R. T. Hill, of Austin, Texas, gave a large piece of a new stone from Travis County, Texas. Mr. S. W. Cramer, of Charlotte, North Carolina, gave a specimen of a new iron from Ellenborough, North Carolina; and from Ward & Howell were received good specimens of irons from Hamilton County, Texas, and Puquios, Chili. Six falls were acquired by exchange with the British Museum and the Museum of Natural History in Paris.

Several papers relating to the work of the department have been published during the year. Notices of them will be found in the Bibliography.

In all, during the year 1213 specimens were added to the reserve collection, and 8198 to the duplicate series; 3215 duplicates were distributed. Last catalogue number in June, 1889, 48468; last catalogue number in June, 1890, 49056.

# REPORT ON THE DEPARTMENT OF GEOLOGY IN THE U. S. NATIONAL MUSEUM, 1890.

By GEORGE P. MERRILL, *Curator.*

On July 1, the curator left Washington, in company with Dr. A. C. Peale, of the U. S. Geological Survey, for three months' field work in Montana and the Yellowstone National Park. The season's work, up to September 1, was mainly in Madison County, though side trips were made to various points in Gallatin and Jefferson Counties. On September 3 I left the surveying party at a point some 20 miles from the State line, in Madison County, and proceeded by team up the Madison River and over Reynolds Pass to Henry's Lake in Idaho, and thence by stage across Tahgee Pass into the Yellowstone Park, remaining there until September 27. The time thus passed was devoted to the collection of materials for the Museum, which will be noticed more fully under the head of accessions. Our thanks are due to both Dr. A. C. Peale and Dr. A. Hague, of the U. S. Geological Survey, without whose assistance and direction but a small proportion of the work accomplished would have been possible.

On returning to Washington (October 1) I was placed in charge of the Department of Metallurgy, the former curator, Mr. F. P. Dewey, having resigned. It having been deemed advisable to combine the Departments of Metallurgy, and Lithology and Physical Geology, this was done, the new Department being the Department of Geology, of which I was appointed curator.

On taking charge I found the metallurgical portion of the new department in the following condition:

The material in the exhibition hall (the southwest court) was arranged mainly in the form of two exhibits; first, a systematic series, comprising varieties of all the principal ores of the metals, arranged and labeled to show methods of extraction in accordance with a hand-book prepared by Mr. Dewey and published in this volume. This collection comprises the metallic ores of gold, silver, lead, copper, iron, zinc, tin, antimony, mercury, aluminum, chromium, bismuth, the alloys, and the non-metallic ores, including sulphur, the natural abrading materials, asbestos, the phosphates, fictile substances, graphite, and the hydrocarbon series, such as coals, petroleum, etc. The graphite and hydrocarbon compounds had not at this time been fully arranged or labeled, nor had the other non-metallic substances mentioned. This collection occupied two flat-top table cases and fourteen floor-upright cases on the western side of the hall.

The second exhibition-series was comprised under the head of the geographical series, and was arranged, by States, in the cases extending entirely around the court, and also in twelve floor-upright cases occupying the east side of the hall. The center of the court was occupied by eight table-cases filled with duplicate and unassorted matter, and carrying flat-top exhibition cases, filled with materials illustrating the Krupp metallurgical works, the mineral resources of Austria, and portions of the Washoe collections of ores. This geographical series comprised some 5,000 specimens, and was but partially arranged. The samples, although mostly identified, were of all shapes, sizes, and quality, nearly all in need of washing and judicious trimming, and many of them suitable only for rejection as soon as better material can be obtained to replace them. It is on this collection, and the material stored in the work-rooms and table-cases, that a very large share of our energies have been expended since November 1. During this time, copy for 3,350 labels has been prepared and sent to the Government Printer.

It was scarcely to be expected that office and laboratory arrangements satisfactory to one curator should be equally so to another, even were it proposed to carry out the same line of work; hence, one of the first tasks undertaken on my assuming charge was that of remodeling the chemical laboratory and offices of the department this being the more necessary from the fact that Mr. Dewey's work was largely of a metallurgical character. The changes in the laboratory arrangements have been made with a view to restoring it to its original condition at the time it was in charge of Mr. F. W. Taylor. It should be stated here that at the time of assuming charge there was but a meager supply of chemicals and apparatus, and such of the latter as there was, had suffered from long use. Up to date something over $200 has been expended for chemicals and apparatus, the more important additions being a "domestic still" for distilling water, and a small air-pump. The department has also been enriched by the receipt of a Grand Model Petrographic Microscope, made by Nachet of Paris.

## NOTES UPON THE MORE IMPORTANT ACCESSIONS.

The accessions of the year which are of especial interest, are enumerated below:

(1) A series of twenty-one transparencies, large size, for windows on south side of west-south range. Gift of the U. S. Geological Survey.

(2) A small series of rocks and ores from the Australian Museum at Sydney, Australia.

(3) A large slab of Potsdam quartzite with tracks of *Protichnites loganus* (Marsh). Gift of C. D. Walcott.

(4) Peridotite from Murfreesborough, Arkansas. Obtained through Prof. J. C. Branner.

(5) A small series of eruptive rocks (basalts, liparites, and siliceous sinters) from Iceland. Gift of Mr. George H. Boehmer.

(6) A small series of Camptonites and porphyrites from New York. In exchange from Prof. J. F. Kemp.

(7) Limonite iron ores from the Katahdin Iron Works, Piscataquis County, Maine. Received in exchange from Prof. F. L. Harvey, Orono, Maine.

(8) Four large pieces of limestone, showing glacial striæ, from St. David's, Ontario, Canada. U. S. Geological Survey.

(9) Specimens of contorted schist and of shell-marl from Dutch Islands, Narragansett Bay, and Acquia Creek, Virginia. Gift of F. W. Crosby, Washington, District of Columbia.

(10) A large stalactite from Howe's Cave, New York. Gift of Dr. Daniel Breed, Washington, District of Columbia.

(11) A fine exhibition series of whetstones, both mounted and unmounted. Gift of the Pike Manufacturing Company, Pike's Station, New Hampshire.

(12) Infusorial earth, Graham Station, Arizona. Gift of J. H. Huntington, Silver City, New Mexico.

(13) Dressed 12-inch cube of diabase ("Gettysburgh Granite") from Gettysburgh, Pennsylvania. Gift of Perry Tawney & Co.

(14) Two models of Mount Shasta, California. From the U. S. Geological Survey. Modeled after surveys of J. S. Diller.

(15) Eighteen boxes of rocks from the quicksilver district of the Pacific slope, as collected and described by geologist G. F. Becker and assistants.

(16) Twenty-two photographs of views in and about the Great Dismal Swamp, Virginia. Presented by I. C. Russell.

(17) A series of specimens of eruptive granites with inclosures, from near Sykesville, Maryland. Collected by the curator.

(18) A small series of eruptive rocks from the Azores Islands, collected by Mr. W. H. Brown as naturalist of the United States Eclipse Expedition to Africa, 1890.

(19) Dressed specimen of coarse gray biotite granite from head of Silver Lake, in Piscataquis County, Maine. Gift of S. and J. Adams, Bangor, Maine.

(20) A large series of rocks and general geological material from Montana and the Yellowstone National Park, collected by the curator during July, August, and September. This includes some one hundred specimens each of rhyolite, obsidian, hornblende andesite, basalt and calc tufa for the duplicate series, as well as large masses of obsidian and tufa, a basaltic column 7 feet high, banded and faulted gneisses, and quite a quantity of eruptive rocks for the exhibition and study-series.

(21) Two samples of dumortierite quartzite from Clip, Yuma County, Arizona. Collected by Dr. W. F. Hillebrand.

(22) Five boxes of rocks representing the Pigeon Point contacts and the Menominee River and Marquette greenstones. Received from Dr. G. H. Williams.

(23) One large slab of sandstone, showing mud-cracks, from Knowlesville, New York. Received in exchange from H. H. Thomas.

(24) A fine sample of tin ore from Cornwall, England. Gift of Mr. Samuel Lanyon.

(25) Specimens of copper ore (chalcocite and malachite) from Allenville, Person County, North Carolina. Gift of W. P. Yancey.

(26) A series of iron ores from Virginia and Tennessee. Gift of Prof. J. H. Morrison.

(27) A sample of silver ore from the Silver Queen Mine, Alaska. Gift of Dr. F. S. Reynolds, through I. C. Russell.

(28) A series of petroleum and derivation products from various sources. Received in exchange from Prof. J. J. Stevenson, New York.

(29) A small series of aluminum and its alloys. Gift of Mr. A. E. Hunt, president of the Pittsburgh Reduction Company.

## CHARACTER OF ROUTINE WORK.

The character of the routine work has not varied materially from that of previous years.

A very large portion of the curator's time has been expended in the dull routine of assorting collections, preparing copy for labels, and replying, or furnishing material for replies, to correspondents in all parts of the country.

The work of identifying material sent to the Museum by persons not officially connected therewith consumes a very considerable amount of time. The following list will give some idea of the character of material sent to the department, not as Museum accessions, but for the purpose of ascertaining its nature and economic value. While the department can not make assays and analyses in such cases, it is assumed that the sender is entitled to a fair answer. In case the work can not be done or the exact information given, it is customary to refer him to other sources.

On Acc. 529: Concretions of clay-iron stone; received from F. A. Degeler, Chehalis, Washington.

On Acc. 562: Vivianite; received from Dr. A. B. Thomas, Lucerne, Putnam County, Missouri.

On Acc. 516: Concretions; received from Miss R. D. Carlock, Worsham, Prince Edward County, Virginia.

On Acc. 577: Nodule of pyrite; received from Henry Berry, Phebe, Union County, Tennessee.

On Acc. 496: Graphite; received from J. L. Obendorf, Downeyville, Nye County, Nevada.

On Acc. 567: Sandstone; received from E. Welvirt, Sunbury, Pennsylvania.

On Acc. 571: Impure magnetic iron ore; received from W. F. Melone, Standardsville, Virginia.

On Acc. 585: Phosphatic sandstone; received from Wood Brothers, Louisville, Kentucky.

On Acc. 588: Sulphide of iron; received from H. G. Rising, San Bernardino, California.

On Acc. 590: Garnet, etc.; received from E. Brooks, Crown Point Center, New York.

On Acc. 595: Material for analysis; received from Ray & Brian, Kissimee, Florida.

On Acc. 596: Ore from I. B. Gray, Trout Creek, Missouri County, Montana.

On Acc. 603: Soap rock; received from C. H. Briggs, Kankakee, Illinois.

On Acc. 602: Ores received from B. F. White, Addison, Maine.

On Acc. 605: Phosphatic material received from George A. Niles, Mannfield, Florida.

On Acc. 608: Black tourmaline; received from George Bishop, Miner's Delight, Wyoming.

On Acc. 606: Mica schist; received from Carrie W. Smith, North Grafton, Massachusetts.

On Acc. 628: Material for testing; received from W. H. Symonds, Utica, New York.

On Acc. 627: Ore; received from L. J. Schultz, Argyle, Wisconsin.

On Acc. 630: Clay; received from S. Heyman, Fayetteville, Tennessee.

On Acc. 637: Gneiss; received from J. L. Estes, Blackshear, Georgia.

On Acc. 638: Ore; received from Frazier Brothers, San Bernardino, California.

On Acc. 640: Granite for analysis and test; received from Virginia Brownstone Company, Covington, Kentucky.

On Acc. 641: Pumice dust; received from G. W. Neckman, Buffalo Park, Kansas.

On Acc. 643: Limestone; received from J. R. Adams, through H. Herbert, Montgomery, Alabama.

On Acc. 650: Rock for analysis; received from W. R. Bush, Lake City, Columbia County, Florida.

On Acc. 649: Sandstone; received from W. H. Clarke, Navy Pay Office, city.

On Acc. 654: Material for analysis; received from E. S. Shuey, Macclenny, Florida.

On Acc. 656: Sand; received from Mrs. A. D. Linnett, New Orleans, Louisiana.

On Acc. 662: Material for analysis; received from S. S. King, Atchison, Kansas.

On Acc. 668: Sandstone; received from F. A. Nelson, Lake City, Florida.

On Acc. 670: Natural concretions; received from T. J. Blalock, Madison, Florida.

On Acc. 673: Indurated clay; received from Dr. G. B. Lartique, Blackville, South Carolina.

On Acc. 692: Rhyolite; received from J. H. Pisor, Horr Post office, Park County, Montana.

On Acc. 691: Calcite; received from Sarah Hollingsworth, Beaver, Douglass County, Missouri.

On Acc. 690: Clay; received from A. B. Prock, Osceola, Missouri.

On Acc. 22,961: Limonite; received from D. W. M. Wright, Holly Brook, Bland County, Virginia.

On Acc. 703: Kaolin; received from Bridgers & Rankin, Wilmington, North Carolina.

On Acc. 713: Material for analysis; received from I. Goldsmith, Carlisle, Grant County, New Mexico.

On Acc. 721: Siliceous sand; received from William B. Farrell, Lake Forest, Illinois.

On Acc. 729: Supposed gold quartz; received from State Senator W. R. Carter, Bronson, Florida.

On Acc. 734: Material for analysis; received from P. T. Cox, Tazewell, Tennessee.

On Acc. 739: Iron ore; from Senator W. B. Allison.

On Acc. 740: Indurated clays; received from J. Olmstead, Pierre, South Dakota.

On Acc. 741: Phosphate rock; received from J. B. Crichton, Ocala, Florida.

On Acc. 742: Supposed petrifaction; received from G. E. Harris, Cassville, Barry County, Missouri.

On Acc. 744: Dolomitic sand; received from J. P. Hamilton, Spokane Falls, Washington.

On Acc. 747: Dolomitic sand; received from W. O. Matzger, Spokane Falls, Washington.

On Acc. 745: Sandstone; received from H. Shriver, Cumberland, Maryland.

On Acc. 746: Oxide of manganese; received from Henry Wozencraft, San Bernardino, California.

On Acc. 755: Supposed cobalt and nickel ore; received from C. T. Washeim, White Plains, Nevada.

On Acc. 757: Marcasite; received from H. Shriver, Cumberland, Maryland.

On Acc. 750: Galena; received from Julius Sherr, Eglon, West Virginia.

On Acc. 758: Nickel; received from H. B. Griffith, Nashville, Tennessee.

On Acc. 763: Cerrusite, etc.; received from Hon. J. H. Ketcham, House of Representatives, Washington.

On Acc. 762: Siliceous sand; received from Hon. H. Clay Evans, House of Representatives, Washington.

On Acc. 765: Clay; received from G. S. Lee, Lyerly, Chattooga County, Georgia.

On Acc. 767: Siliceous limestone; received from H. C. Whiting, 1919 G street, city.

On Acc. 768: Material for assay; received from C. E. Stewart, Rockwood, Tennessee.

On Acc. 770: Concretions; received from M. J. Becker, Fort Scott, Kansas.

On Acc. 773: Material for analysis; received from J. McDonald, Big Bug, Arizona.

On Acc. 775: Supposed tin ore; received from Sloan & Ferguson, Bozeman, Montana.

On Acc. 777: Biotite granite; received from S. & J. Adams, Bangor, Maine.

On Acc. 780: Supposed iron ore; received from Dr. A. M. Bourland, Van Buren, Arkansas.

On Acc. 23,272: Chalcopyrite, shell limestone and lava; received from U. S. Eclipse Expedition to Africa; collected by H. Brown.

On Acc. 786: Material for assay; received from James Gillespie, San Bernardino, California.

On Acc. 787: Concretion; received from J. L. Carter, Kingston, Alabama.

On Acc. 789: Material for assay; received from John Park, Red Bluff, Montana.

On Acc. 791: Calcareous sandstone; received from R. A. Mills, Chulusta, Orange County, Florida.

The general character of the strictly Museum work, so far as it relates to the preparation and arrangement of materials for the exhibition and study series, may be best understood by reference to the preliminary handbook of the department, as it appeared in appendix of the Museum report for the year ending June 30, 1889.

It may, however, be said here that the present force of the department is far too small for systematic work. The time is passed in the continual struggle to keep up with the routine, and the amount of actual progress, as displayed by permanent results, is discouragingly small. Up to March 15, 1890, I was assisted by Messrs. W. H. Newhall and W. B. Merrimon. The latter having on March 15 resigned to go into the Census Office, the entire work of the department has since been carried on by Mr. Newhall and myself, assisted from time to time by a Museum laborer.

Comparatively little has been done in the way of sending out material for exchange during the year. The following list includes all the items of importance coming under this head:

*October* 26, 1889.—To George H. Barton, Boston Society of Natural History, Boston, Massachusetts, 41 specimens miscellaneous rocks.

*November* 8, 1889.—To Dr. A. Brezina, Vienna, Austria, 41 specimens miscellaneous rocks.

*December* 17, 1889.—To Father Orbon, of the New Catholic University, Washington, District of Columbia, 30 specimens, type series of rocks.

*February* 19, 1890.—To U. S. Geological Survey, city, 9 specimens oölitic rocks.

*March* 22, 1890.—To Hon. G. G. Vest, 5 specimens of ores.

*March* 5, 1890.—To Prof. W. S. Bayley, Colby University, Waterville, Maine, 13 specimens of eruptive rocks.

*April* 4, 1890.—To Prof. Ernest van der Broeck, Brussels, Belgium, 16 specimens oolitic rocks.

*May* 16, 1890.—To Prof. J. J. Stevenson, University of the City of New York, 15 specimens of ores.

*June* 2, 1890.—To Dr. Moor, Sioux Falls, Dakota, 6 samples infusorial earth.

*June* 20, 1890.—To Prof. C. R. Van Hise, Madison, Wisconsin, 121 specimens rocks collected by the Fortieth Parallel Survey. (Lent for study.)

### REVIEW OF SPECIAL RESEARCHES.

Owing to the increase of routine work involved in the combination of two departments, no time could be spared for investigation or original research other than that necessary for the satisfactory determination of the materials handled.

The titles of such papers as have been published are given in the Bibliography. Various officers of the U. S. Geological Survey have, from time to time, had access to the collections, and if necessary, have been supplied, so far as the collections would admit, with material for investigation. Mr. Waldemar Lindgren has thus been furnished with samples from the Bear Paw Mountains in Montana, and some 121 specimens of rocks collected by the geologists of the Fortieth Parallel Survey have been lent to Mr. C. R. Van Hise, of Madison, Wisconsin.

### PRESENT STATE OF THE COLLECTION.

Ignoring for the time the material still in storage (some three hundred boxes) or as yet unpacked and assorted, and concerning which the curator has at present little definite knowledge, and bearing in mind the remarks made under this head in my last annual report, the following general summary may be given. No estimate is made of the number of specimens of ores in the reserve and duplicate series.

| | | |
|---|---|---|
| | A.—*Systematic Geology.* | |
| I. | Rocks and rock-forming minerals | 2,500 |
| II. | General geology | 1,800 |
| | B.—*Economic Geology.* | |
| I. | Building and ornamental stones, and stones used in sharpening edge tools. | 3,270 |
| II. | Systematic series of ores | 3,676 |
| III. | Geographic series of ores | 5,516 |
| | Total exhibition series | 16,762 |

In addition to the above are some 16,000 specimens, mostly petrographical material, stored for study and comparison in the drawers of table cases.

In connection with the system of cataloguing in the Department of Metallurgy I find four catalogues upon which entries have been made as below:

First entry in July '89—51663, 59602, 66585, 68472.

Last entry in June '90—51675, 59980, 66675, 68492.

In the catalogue devoted heretofore to the Department of Lithology and Physical Geology the entries during the year run from 70,692 to 72,959.

# SECTION III.

## PAPERS DESCRIBING AND ILLUSTRATING THE COLLECTIONS IN THE U. S. NATIONAL MUSEUM.

Pages.

1. The Humming Birds. By Robert Ridgway .......... 253–383
(Plates I–XLVI. Figs 1–47.)

2. White-line engraving for relief-printing in the 15th and 16th centuries. By S. R. Koehler .......... 385–394
(Plates XLVII–L. Figs. 48–50.)

3. The Methods of Fire-making. By Walter Hough .......... 395–409
(Plate LI. Figs. 51–63.)

4. The Ulu, or Woman's Knife, of the Eskimo. By Otis T. Mason .......... 411–416
(Plates LII–LXXII.)

5. The Ancient Pit-dwellers of Yezo. By Romyn Hitchcock .......... 417–427
(Plates LXXIII–LXXX. Figs. 64–67.)

6. The Ainos of Yezo, Japan. By Romyn Hitchcock .......... 429–502
(Plates LXXXI–CXVII. Figs. 68–88.)

7. Hand-book for the Department of Geology in the U. S. National Museum. Part I, Geognosy: The materials of the earth's crust. By George P. Merrill .......... 503–591
(Plates CXVIII–CXXIX. Figs. 89–98.)

8. The Catlin Collection of Indian Paintings. By Washington Matthews, M. D., Surgeon U. S. Army .......... 593–610
(Plates CXXX–CL.)

9. The Log of the Savannah. By J. Elfreth Watkins .......... 611–639
Plates CLI–CLVI.)

10. Anthropology at the Paris Exposition in 1889. By Thomas Wilson .......... 641–680
(Plates CLVII–CLXIII. Fig. 99.)

# THE HUMMING BIRDS.

By Robert Ridgway.

## INTRODUCTION.

Minutest of the feathered kind,
Possessing every charm combin'd,
Nature, in forming thee, design'd
That thou shouldst be

A proof within how little space
She can comprise such perfect grace,
Rendering thy lovely fairy race
Beauty's epitome.

Thou burnished colors to bestow,
Her pencil in the heavenly bow
She dipp'd, and made thy plumes to glow
With every hue.

—Charlotte Smith.

Of all the numerous groups into which the birds are divided there is none other so numerous in species, so varied in form, so brilliant in plumage, and so different from all others in their mode of life. Inhabitants exclusively of the tropical and temperate portions of America, they constitute the most charming element in the wonderfully varied bird-life of the New World. Buffon considers the Humming Bird "of all animated beings . . . the most elegant in form and brilliant in color. The stones and metals polished by art are not comparable to this gem of nature. She has placed it in the order of birds, but among the tiniest of the race—*maxime miranda in minimus;* she has loaded it with all the gifts of which she has only given other birds a share. Agility, rapidity, nimbleness, grace, and rich attire all belong to this little favorite. The emerald, the ruby, and the topaz glitter in its garb, which is never soiled with the dust of earth, for, leading an aërial life, it rarely touches the turf even for an instant. Always in the air, flying from flower to flower, it shares their freshness and their splendor, lives on their nectar, and only inhabits those climates in which they are unceasingly renewed." Audubon calls the Humming Bird a "glittering fragment of the rainbow," and asks: "Who, on seeing this lovely little creature moving on humming winglets through the air, suspended as if by magic in it, flitting from one flower to another, with motions as graceful as they are light and airy, pursuing its course and yielding new delights wherever it is seen . . . would not pause, admire, and turn his mind with reverence toward the Almighty Creator, the wonders of whose hand we at every step discover, and of whose sublime conception we everywhere observe the manifestations in his admirable system of creation?"

Buffon's characterization, however, is somewhat inaccurate and slightly overdrawn, since nature has *not* endowed Humming Birds "with *all* the gifts of which she has only given other birds a share," the absence of melodious voice being, as a rule, a conspicuous deficiency of the tribe, while the statement that they are "always in the air" is very inaccurate, Humming Birds requiring the same repose which other kinds find necessary.

The author of that magnificent work, "A Monograph of the Trochilidæ"—Mr. John Gould—in recounting his own experience with Humming Birds, if less extravagant in his praise of them is no less enthusiastic in his admiration. "That early impressions of the mind," says he, "are vividly retained, while events of the day flit from our memory, must have been experienced by everyone. How vivid, then, is my recollection of the first Humming Bird which met my admiring gaze! With what delight did I examine its tiny body and feast my eyes on its glittering plumage! This early impression, I well remember, gradually increased into an earnest desire to attain a more intimate acquaintance with the lovely group of birds to which it pertained, and was still further strengthened when an opportunity was afforded me of inspecting the, at that time, unique collection of the *Trochilidæ* formed by the late Mr. George Loddiges, of Hackney. This gentleman and myself were imbued with a kindred spirit in the love we both entertained for this family of living gems. To describe the feeling which animated us with regard to them is impossible. It can, in fact, only be realized by those who have made natural history a study, and who pursue the investigation of its charming mysteries with ardor and delight. That our enthusiasm and excitement with regard to most things become lessened, if not deadened, by time, particularly when we have acquired what we vainly consider a complete knowledge of the subject, is, I fear, too often the case with most of us; not so, however, I believe, with those who take up the study of the family of Humming Birds. Certainly I can affirm that such is not the case with myself; for the pleasure which I experience on seeing a Humming Bird is as great at the present moment as when I first saw one. During the first 20 years of my acquaintance with these wonderful works of creation my thoughts were often directed to them in the day, and my night dreams have not unfrequently carried me to their native forests in the distant country of America.

"In passing through this world I have remarked that when inquirers of a strong will really set themselves to attain a definite object they generally accomplish it; and in my own case the time at length arrived when I was permitted to revel in the delight of seeing the Humming Birds in a state of nature, and to observe their habits in the woods and among the great flowering trees of the United States of America and in Canada."

It is not the naturalist alone, however, who has been attracted by the wonderful beauty of Humming Birds. The demand for them is great for purely ornamental purposes, and though this has vastly added to their destruction it has, as a fortunate recompense, enabled naturalists to become better acquainted with them, the immense number of specimens often contained in milliners' and taxidermists' stocks frequently yielding species which otherwise would scarcely have become known to science. "Both Frenchmen and Belgians," says Mr. Gould, "have proceeded to South America to procure supplies of these birds, and dealers from those countries have established themselves in some of the cities of that part of the world for the like purpose. From Sta. Fé de Bogota alone many thousands of skins are annually sent to London and Paris, and sold as ornaments for the drawing-room and for scientific purposes. The Indians readily learn the art of skinning and preserving, and, as a certain amount of emolument attends the collecting of these objects, they often traverse great distances to p ocure them; districts more than a hundred miles on either side of Bogota are strictly searched; and hence it is that from these places alone we receive not less than seventy species of these birds. In like manner the residents of many parts of Brazil employ their slaves in collecting, skinning, and preserving them for European markets, and many thousands are annually sent from Rio de Janeiro, Bahia, and Pernambuco. They also supply the inmates of the convents with many of the more richly colored species for the manufacture of artificial feather-flowers." Vast numbers are also used by the natives of Mexico in producing the wonderful feather pictures for which the descendants of the Aztecs are famous.

Regarding the method by which specimens of these dimunitive birds are obtained by the collector, there exists much popular misunderstanding. "Many really absurd statements," says Mr. Gould, "have been made as to the means by which these birds are obtained for our cabinets. It is most frequently asserted that they are shot with water or with sand. Now, so far as I am aware, these devices are never resorted to, but they are usually procured in the usual way, with Nos. 10 and 11 shot, those being the sizes best suited for the purpose. If smaller shot be used the plumage is very frequently so cut and damaged that the specimen is rendered of little or no value. By far the greater number fall to the clay ball of the blowpipe, which the Indians, and in some instances even Europeans, use with perfect certainty of aim. . . . . In Brazil very fine nets are employed for this purpose, but how this engine is employed I am unable to state. Unfortunately for me many specimens of the fine species *Cometes sparganurus*[*] in my possession have been obtained by means of birdlime, and this is evidently the way in which these birds are captured in the neighborhood of Chuquisaca."

On account of the immense destruction of Humming Birds for the various ornamental purposes mentioned above, certain species are said to be on the verge of extinction. The wonder is that they are not long ago extinct, for the number of individuals which have been destroyed is simply beyond computation. Three thousand skins of the Ruby-and-topaz Humming Bird (*Chrysolampis moschitus*) alone are said to have been shipped from a Brazilian port *in a single consignment*, while at a public sale of bird skins, held in London, March 21, 1888, more than 12,000 Humming Bird skins were disposed of! And in one week during the same year, there were sold at auction in London 400,000 Humming Birds, and other birds from North and South America, the former doubtless comprising a very considerable percentage of the whole number.[†] Surely this stupendous slaughter foreshadows the speedy extermination of many species. If it does not, what a commentary on the amazing wealth of bird-life in the tropics of America!

## EARLY HISTORY.

Humming Birds being one of the special products of the New World, and consequently unknown to the ancients,[‡] it of course follows that their literature is confined to the period following the discovery of America by Columbus. According to Lesson, "The first mention which is made of Humming Birds in the narratives of adventurers who proceeded to America, not with the design of studying its natural productions, but for the discovery of gold, dates from 1558, and is to be found in Les Singularités de la France Antarctique (Brazil) of André Thevet and Jean de Léry, companions of La Villegaignon, who attempted in 1555 to found a French colony there; but these superficial accounts would not have unfolded their natural history had not the old naturalists who published their observations at the commencement of the seventeenth century taken care to make them better known; and we find some good accounts of them in the voluminous compilation of Nieremberg, in the collection of fragments from the great works of Hernandez or Fernandez, and in those of Piso. Ximenez, Acosta, Gomara, Marcgrave, Garcilasso, and Dutertre often mention these birds, but their remarks are so superficial that it would be of little use to quote them now. Towards the end of the same century Sir Hans Sloane, Catesby, Edwards, Brown, Father Labat, Plumier, Louis Feuillée, and Rochefort gave tolerably complete figures and descriptions of some of the species, but it was not until the commencement of the eighteenth century that we became better acquainted with their natural history." The naturalist-traveler Marcgrave minutely described several species of Humming Birds in his Natural History of Brazil,[*] published in Amsterdam in 1648, an entire chapter (IV, pp. 196–198) being devoted to these birds under the heading of "Various species of Guainumbi" (*Guainumbi variæ species*), *Guainumbi* or *Guinambi* being the Brazilian name for a Humming Bird, as are also, in the language of separate tribes, the terms *Aratica* and *Arataratagu-acu*. Humming Birds were also well described by César de Rochefort in his Histoire Naturelle et Morale des Îles Antilles de l'Amérique (published in 1658), in which also they were allotted a special chapter (Article XVII, pp. 176–181).

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[*] For a description of this exquisitely beautiful bird see pages 308, 309.

[†] This information is taken from The Auk, July, 1888, pp. 334, 335.

[‡] It is true that the name of the typical genus (*Trochilus*), from which the name of the family (*Trochilidæ*) is taken, is a classical Greek name, Τρόχιλος, *trochilus* or *trochilos;* but the bird so called by Herodotus was the Crocodile bird (*Pluvianus ægyptius*), a small, ploverlike bird, which is said to feed upon the leeches which fasten themselves to the crocodile, even entering the monster's open mouth to do so.

The earliest notice of the common Ruby-throated Humming Bird (*Trochilus colubris*) of eastern North America that I have been able to find is an extract from "a letter written from Boston in New England, October 26, 1670," by John Winthrop, Esq., governor of Connecticut, to Francis Willughby, Esq., and published in the Philosophical Transactions, vol. VI (1671), p. 2223. It refers to a nest and two eggs, evidently a great curiosity at that time, as the article which follows will show:

> I send you withal a little Box, with a Curiosity in it, which perhaps will be counted a trifle, yet 'tis rarely to be met with even here. It is the curiously contrived Nest of a Humming Bird,[†] so called from the humming noise it maketh whilst it flies. 'Tis an exceeding litle Bird, and only seen in Summer, and mostly in Gardens, flying from flower to flower, sucking Honey out of the flowers as a Bee doth; as it flieth not lighting on the flower, but hovering over it, sucking with its long Bill a sweet substance. There are in the same Nest two of that Birds Eggs.[‡] Whether they use to have more at once, I know not. I never saw but one of these Nests before; and that was sent over formerly, with some other Rarities, but the Vessel miscarrying you received them not.

Twenty-two years later, there appeared in the same journal (Philosophical Transactions, vol. XVII, 1693, pp. 760–761), what seems to be the first special description of the bird itself, entitled "The description of the American Tomineus or Humming Bird, communicated by Nehemiah Grew, M. D. and Fellow of the Royal Society," which also is worth quoting in full, the description having been written "by Mr. Hamersly, of Coventry:"

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[*] Historia Natvralis Braziliæ, Auspicio et Beneficio Illustriss. I. Mavritii Com. Nassav. [etc.]. By Guilelmi Pisonis, M. D., and Georgi Marcgravi de Liebstad.

[†] Of which see a notable Description in the History of the *Antiles l.* 1. 6. 15. art. 17, where it hath the name of *Colibry*.

[‡] These Eggs were so small, that being weighed by the Publisher, the one weighed but about 5 grains, the other 3½: And the whole Nest weighed no more than 24 grains.

There is in most parts of *America* a Bird called by the *English* the *Hum Bird*, by the *Spaniard Tomineus*. He is of the most shining green Color [*sic*], and very resplendent; the Colour [*sic*] doth something resemble some of our *English Drake-heads*. It doth inhabit some of the colder parts of *America*, as well as in the hotter. It is the least of all Birds that I have seen there or in *England*; her Leg and Foot together is but half an Inch, the other parts answerable, and the Trunk of her Body not an inch. I did weigh one (in those parts) as soon as ever it was kill'd, whose Weight was the tenth part of an Ounce *Avoirdupoize*, which I take to be about the weight of a Coined Six-pence. And I have weighed here in *England* a *Tit-mouse* (which I take to be the least Bird here), and it weighed above Two Shillings, and some Half a Crown. I saw one of these Nests made of Cotton-Wool, in form and bigness of the Thumb of a Man's Glove, with the Taper end set downwards, wherin were two Eggs of the bigness of a Pea, of oval Form. Who can but admire to see the whole Body, and all the parts of a Bird folded up in an Egg, little bigger than a Pepper-Corn? They feed by thrusting their Bill and Tongue into the blossoms of Trees, and so suck the sweet Juice of Honey from them; and when he sucks he sits not, but bears up his Body with a hovering Motion of his Wings: But for the relation that he is a curious singing Bird, I think it untrue. God in many of his Creatures is bountiful, yet not lavish; for I did observe them several years, but never heard them sing; and the Peacock and Jay, though they be of a fine Plume, yet no Singers; and so I think this Bird is so beautiful to the Eye, as not to please the Ear. An *Indian Saggamore* is not in his full Pomp and Bravery without one of these Birds in his Ear for a Pendant. He is called the *Hum-Bird* or *Humming-Bird*, because some say he makes a noise like a Spinning Wheel when he flies, which I think rather an Imagination than real; for I have been many times very near them, both when they hover'd and when they did fly, and I never heard any Noise; besides, their Body and Wings are too small to strike Air enough to make any Noise.* But of this I shall not be positive, because some Authors are opposite to me. It is a Solitary Bird: I never saw but two at a time together, *viz.* the Male and the Female, they being easily known when together, the Male being somewhat bigger than the Female.†

If one takes a small Bird's Wing, and stand 4 or 5 yards from a Candle (when dark) and open the Wing, and look thro' it at the Candle, he may see a most elegant Colour of red and green, which green doth something resemble the Colour of this Bird.

The technical literature pertaining to Humming Birds is very extensive, perhaps exceeding in the number of separate titles that of any other group. "Most of it," says Dr. Coues, "is 'special,' that is, represented by books and papers exclusively devoted to this group of birds." "Hummers," says the learned bibliographer just quoted, "are very peculiar birds, and their study may almost be said to form a particular department of ornithology; in fact, the word 'trochilidist' has been coined to designate those who pay special attention to this branch of science; and there are few ornithologists who, however great their general acquirements, can be considered experts in this study.‡"

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* Perhaps the writer's hearing was defective.

† Another error; the reverse being the case when there is any difference in size between the sexes. It is singular he did not notice the difference of color between the sexes, the brilliant ruby throat of the male being so conspicuous an ornament.

‡ Third Installment of American Ornithological Bibliography. By Dr. Elliott Coues, U. S. A. Bulletin of the U. S. Geological and Geographical Survey of the Territories, vol. v, No. 4, 1879, p. 690.

In this exceedingly useful work, there are given under the heading of *Trochilidæ* (pp. 659–690) nearly three hundred separate titles, which shows how favorite a fam-

The extent to which our knowledge of Humming Birds has grown may be realized when it is considered that in 1758, when the tenth edition of Linnæus's Systema Naturæ was published, only eighteen species were known, while at the present time the total number of recognizable species and subspecies is not far from five hundred. The gradual evolution of our knowledge on the subject is thus outlined by Dr. Coues in the bibliography from which we have previously quoted:

> In 1758, when Linnæus applied his system consistently to birds, in the tenth edition of the Systema Naturæ, he used the classic word *Trochilus* for a genus coextensive with the modern family *Trochilidæ*, and catalogued 18 species, mostly based upon descriptions or figures furnished by Seba, Brown, Sloane, Catesby, Edwards, Clusius, and Albin, with references also to the Mus. Ad. Fr. In the twelfth edition, 1766, this number was increased to 22, with many additional references, as to Marcgrave, Willughby, Ray, and especially Brisson.
>
> In 1760, the last-named famous ornithologist gave us what may be deemed the first extended or in any sense "monographic" account of *Trochilidæ*. Studiously collating the already numerous notices scattered through works of the character I have mentioned, as well as through the illustrated and other natural history treatises of his predecessors in ornithology, he was enabled to describe with his customary elaboration no fewer than 36 species and to present a copious bibliography. He also made the first tenable genera of Hummers after *Trochilus*, dividing the whole family into two groups, *Polytmus* and *Mellisuga*, one containing large species with curved bills, the other small species with straight bills. In this action of Brisson's we see the origin of the curious fashion which so long endured among French writers, that of distinguishing "Colibris" from "Oiseaux-mouches" among *Trochilidæ*. It is also notable as the starting-point of a generic subdivision of the group which was destined at length to reach the farcical and scandalous extreme of some 350 genera for few more than 400 known species.
>
> In 1779, Buffon adopted the same two divisions of "Colibris" and "Oiseaux-mouches," presenting 19 species of the former and 24 of the latter group, a total of 43 *Trochilidæ*. If we except the mere naming and describing of some additional species by Gmelin and Latham, nearly all that had been learned of the birds up to the close of the last century was reflected in the works of these two famous French authors.
>
> In 1788, the industrious but indiscriminate and incompetent compiler of the Thirteenth edition of the Syst. Nat. produced a total of 65 species of *Trochilus*. None were described except at second-hand, but to many of them binomial names were first affixed. Two years afterward 65 species of *Trochilus* were recorded in the Ind. Orn. of Latham.*
>
> We are thus brought, by the stepping-stones of but few works requiring special mention here, to the opening of the nineteenth century, which saw Audebert and Vieillot's luxurious work, Ois. Dorés, perhaps the first ornithological work which

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ily this has been with writers. An "Addendum to the Trochilidæ (pp. 690–692), which embodies a systematic review of Trochilidine literature, and an "Index Generum Trochilidarum" (pp. 692–696), consisting of an alphabetical list, with references, of no less than four hundred and six different generic names (including sometimes two or more different spellings of the same name), render this bibliography very complete up to date, and quite indispensable to any one doing special work upon this group of birds.

* The eighth volume, 1812, of Shaw's Gen. Zool. gave 70 species of *Trochilus*.

undertook to reproduce metallic reflections of plumage. The feathery Iris of these exquisite creatures is always fascinating, and there are no more favorable subjects for glittering plates. The work, indeed, was not exclusively a monograph of the Hummers, but the Histoire Naturelle des Colibris et des Oiseaux-mouches formed a large part of the undertaking. Scientific names were not used in the Ois. Dor., but a technical nomenclature of the subjects of the work was furnished by Vieillot in 1817.

The first great illustrated work on Hummers exclusively was Lesson's, published in parts, from 1829 to 1832, the parts being afterward grouped in three separately titled volumes. This author described and figured in colors upward of 100 (about 110) species, many of which were actually new, and to many more of which new names were given. A very few genera, additional to or in place of Brisson's, had meanwhile been proposed; but Lesson was the first to introduce any considerable number of new generic names. Many of those, however, which Gray and others have since cited as generic, were certainly not used or intended as such by Lesson, being simply vernacular designations of certain "tribes" and "races" among which he distributed the *Trochilidæ*, such words as "Bleuets" and "Queues étroites," for example. French authors were (and I think many of them still are) such sinners in spelling that it is not always easy to say what words of theirs they would have us take as technical. Possessing a copious and voluble vocabulary, largely supplemented by gesture-speech or shrug-language, and violating in their articulation the usual powers of written characters, they not only acquired a trick of gallicizing technical words, but they also cultivated a characteristic habit of rising superior to orthography. If Vieillot could write *Cripsirina* for *Cryptorhina* without flinching, we need not wonder that Lesson invented *Ornismya*, which he defended as against *Ornithomyia*, or that some of his successors reached the height of *Ornysmia*!

The Hummers have always been objects of study peculiarly agreeable to French ornithologists. Their daintiness, so to speak, seems to suit the national genius. French literature, therefore, figures in the written history of these birds to an extent greater than that observable in any other family of birds. About the time we have reached, however, several English names became prominent in the present connection, as those of Swainson, Vigors, Loddiges, and especially Jardine, for Gould had not then begun the work which was afterward to identify his name with Trochilidine literature. Swainson had already classified the Hummers as a part of his general scheme, describing some new species and establishing certain genera. In 1833, and thus upon the heels of Lesson's memoirs, Sir William Jardine prepared his monography, to the valuable and agreeable text of which Lizars contributed beautiful illustrations. The home of the Hummers was heard from the same year in La Llave's *Memoria*, and Schreibers's *Collectanea* of same date consisted only of these birds. From this time until the beginning of Gould's great work in 1849 appeared no monographic treatise on *Trochilidæ*. But the period was one of great activity, among both English and French writers; the accumulation of material was rapid and incessant, and many papers of these years described new genera and species, though too often hastily and inadequately. In England, Gould and Fraser were busy with their materials. In France, the writings of Lesson continued; Bourcier became prominent in the number of his papers; while Boissoneau, De Lattre, Gervais, Longuemare, and others made their respective contributions. This was the period of accumulation rather than of elaboration; numberless new names were introduced, but among them were many synonyms, both generic and specific, little or no systematic revision of the subject being effected, unless Gould's *Draft Arrangement*, the precursor of his *Monograph*, be considered of such character.

The thirteen years, 1849–1861, during which Gould's work was pending, marked the next period in the history of the subject. The preparation of this great work held its author, already recognized as the leading Trochilidist, to his subject; and the appearance of successive parts served as a continual stimulus to others to move in the same direction. The author published many papers describing cursorily new objects about to be depicted in his magnificent folios, and several French ornithologists, notably Bourcier and Mulsant, were little behind him in this respect. The period was also marked by the appearance in England of Martin's *General History*, in some sense a continuation of Jardine's work. It was furthermore characterized by the malignant epidemic which we may call the genus-itch, which broke out simultaneously in 1849, from two foci of contagion, in France and in Germany, and proved disastrous in the extreme. The infection reappeared in an aggravated form in 1854, and Trochilidine literature has never entirely recovered from its effect.

Many genera of Hummers, notably Swainson's, Lesson's, and Gould's, had been found acceptable and, indeed, necessary; but the most embarrassing results attended the steps of some authors who coined names on the glancing of a feather in this beautiful group of birds. As just stated, serious difficulty began in 1849, in those parts of Bonaparte's *Conspectus* and of Reichenbach's *Systema* which treat of *Trochilidæ;* and in 1854 each of these authors increased it immeasurably, the one in his *Tableau*, the other in his *Aufzählung*. But I have on previous pages sufficiently commented upon this matter.

The completion of Gould's splendid monument closed this period of accumulation. The subject had grown rapidly and had become unmanageable. Some authors had simply amused themselves in "playing chess" with the names of Hummers, and many had pressed forward with new species upon insufficient examination of known material or inadequate regard for what others had published. The fog of synonymy had completely enveloped the subject. It was hazardous to enter it, and it seemed almost hopeless to attempt to lift it. The *Monograph* represented, therefore, rather a broad and secure basis for future investigation than any final accomplishment. It gave a series of 360 colored plates of about as many species, real or nominal, with accompanying descriptive letter-press, other species added in the *Introduction* raising the total to 416, referred to 123 genera. But many new names, generic and specific, were still to see the light; many others were to sink into synonymy; the nomenclature was still shifting; in short, studious and judicious systematic revision of the whole subject was imperatively demanded. If Gould's work made this necessity apparent, it also immeasurably contributed to the desired result.

Previous to this Gouldian period American writers did next to nothing for the special literature of the family; but during this time and subsequently many new species were described by Lawrence. In 1860, and therefore just before the period closed, Germany brought a fascicle of the *Museum Heineanum* to bear upon the subject, many new genera and some new species being described by Cabanis and Heine. In 1863 the *Trochilidica* of the last-named author appeared in the *J. f. O.*, with a similar result. In 1866 MM. Mulsant and Verreaux's *Essai d'une Classification Méthodique* appeared as the precursor of a more elaborate work then contemplated, containing fresh accessions to the number of genera with which the family was destined to be burdened and a rearrangement of the whole group. This decade, 1861–1870, saw also a fair number of minor papers, calling, however, for no special remark here. It represented flood-tide in the mere describing of species, and their rearrangement in futile genera; the ebb necessarily followed.

The state of the case at that moment was faithfully reflected in Gray's Handlist. This catalogued 469 species, real or nominal, distributed in 163 genera or subgenera and carrying a load of synonymy amounting in the aggregate to perhaps 800 specific and 300 generic names. This, it will be remembered, is irrespective of the endless combinations of generic and specific names which, were they counted, might represent a total of several thousand binomial names which have been imposed upon a family of birds consisting of few more than 400 known species, conveniently referable to about one-fourth as many modern genera!

Such a state of things as this inevitably tended toward a healthy reaction; and during the last decade the accessions of new names have been fairly offset by the reduction of others to synonyms. It is true that the *Histoire Naturelle des Oiseaux-mouches* of MM. Mulsant and Verreaux and M. Mulsant's *Catalogue*—these being among the most notable publications of this period—can scarcely be regarded as tending in this direction, viewing the many additional new names which they present. Having seen neither of these treatises, I can not judge of their claims to be considered as advancing or improving the science. But it can not be doubted that the patient and faithful study which Messrs. D. G. Elliot and O. Salvin have of late applied to the amelioration of Trochilidine affairs has done much toward the needed reform. These skillful ornithologists have published numerous papers reviewing different groups of Hummers, under the most advantageous circumstances as regards handling material and examining literature, and their criticisms have been of the greatest service, not only in defining genera and species, but in sifting synonymy and settling nomenclature. Mr. Elliot's labors have borne their final fruit in his *Classification and Synopsis of the Trochilidæ*. However qualified a success the experts may conclude this performance to be, it is certainly a great boon to the working ornithologist, and a faithful reflection of the present state of our knowledge respecting the exquisite creatures to the elucidation of whose history it is devoted.

## NAMES AND THEIR ORIGIN.

The origin and meaning of the term "Humming Bird" and of other names by which these birds are known in various languages are very tersely explained by Mr. Gould in his magnificent Monograph of the Trochilidæ, as follows:

> The questions have often been asked, Whence is the term Humming Bird derived? and Why is the bird so called?
>
> I may state in reply that owing to the rapid movement of the wings of most of the members of this group, but especially of the smaller species, a vibratory or humming sound is produced while the bird is in the air, which may be heard at the distance of several yards, and that it is from this circumstance that the trivial name by which these birds are known in England has arisen. In France they are recognized by the terms *Oiseau-Mouche* [fly-bird] and *Colibri*; in Germany their common appellation is *Kolibri*; by the Dutch they are called *Kolibrietje*; by the Spaniards, *Picaflores* [flower peckers] and *Tomino*; by the Portuguese, *Tomeneco* and *Beija flor*; in the neighborhood of Xalapa they are known by the names of *Chupa-rosa* and *Chupa-myrtu*, Rose-sucker and Myrtle-sucker; by the Creoles of the Antilles and Guiana they are known by the names of *Murmures* [murmurers], *Bourdons*, and *Frou-frous*. From the Mexicans, Peruvians, and other nations of South America they have received various appelations, such as *Ourissa*, *Huitzitzil*, *Tzitzotoll*, *Guanumbia*, *Quinti* or *Quintiut*, *Quindé*, *Visiclin*, *Pigada*, and *Courbiri*, all terms of a metaphorical character, signifying "rays of the sun," "tresses of the day-star," "murmuring birds," etc.

In addition to the foregoing, Marcgrave mentions *Guainumbi* or *Guinambi*, *Aratica*, and *Arataratagnaca* as names by which they were known among the Brazilian Indians of his day. The English name, Humming Bird, is sometimes shortened into Hummer, but this term is not so satisfactory as the other, notwithstanding the advantage of brevity.

## GEOGRAPHICAL DISTRIBUTION.

The Humming Birds, more than any other family, constitute the most remarkable feature of the New World bird-life. They have absolutely no representatives in any other part of the world, the Swifts being the nearest relatives they have in other countries. When, in the classification of birds, superficial or general resemblance was more considered than structural affinity, the Humming Birds were supposed to have representatives in the tropical regions of the eastern hemisphere in the Sun Birds (*Nectariniidæ*); but the latter belong to a different order, *Passeres*, and are not very unlike, in their general structure, the American family of Honey Creepers (*Cœrebidæ*), of which they may be considered the more brilliantly colored Old World analogues.

Of all the many families of birds which are entirely peculiar to the rich bird-fauna of America, the Humming Birds probably constitute the most numerous assemblage, about 500 distinct kinds being now known, while others are being brought to light with almost every fresh collection made in Mexico, Central America, or the higher lands of South America.

They abound most in mountainous countries, where the configuration of the surface and productions of the soil are most diversified within small areas. Their center of abundance is among the northern Andes, between the parallels of 10 degrees north and south of the equator, from which region they gradually diminish in numbers both to the northward and southward, but much more rapidly toward the extensive lowlands of the eastern portion of the continent. The northern limit of their abundance may be approximately given as the Tropic of Cancer, beyond which but few of the fifty Mexican species extend, while only eighteen of them have been detected across the boundary line in the equally mountainous portions of the southwestern United States, including the semitropical Rio Grande Valley. Small as this number may appear, the southwestern portion of the Union may be considered richly endowed compared with the vast valley of the Mississippi and the Atlantic water-shed, a region of unsurpassed fertility and luxuriant vegetation, yet which throughout its whole extent, even including the peninsula of Florida, possesses only a single species of Humming Bird! In this scarcity, compared with the western mountainous regions, of representatives of a numerous family of birds, we see a certain parallelism with the lowlands of eastern South America as compared with the Andean highlands, only, on account of climatic differences, the contrast is by far more marked. A peculiar group of Humming Birds, the Hermit Hummers (genera *Phaëthornis*, *Glaucis*, *Androdon*, and *Rhamphodon*), is more numerously represented in Brazil than elsewhere. These are all very plainly colored birds, with little metallic coloring, sometimes none, and instead of living in the sunshine and feeding among flowers they inhabit the gloomy forests and subsist wholly on insects gleaned from the branches and leaves of trees. Apart from these, however, Humming Birds are poorly represented in Brazil, compared with the Andean highlands. Mr. Gould comments on this as follows:

> Other beautiful kinds do here and there exist in Brazil, such as the *Chrysolampis moschitus* [Ruby and Topaz], the *Topaza pella* [Topaz-throat], and the *Lophornithes* [Coquette Humming Birds]; but the greater number are comparatively small and

inconspicuous. Of the members of the genus *Phaëthornis*, a group of Humming Birds popularly known by the name of Hermits, from their frequenting the darkest and most retired parts of the forest, three-fourths are natives of Brazil. The great forest-covered delta of the Amazon, where palms are numerous, seems to be particularly unfavorable to the Trochilidæ, since from Pará to Ega there are scarcely ten species of the family to be met with.

Taking the different countries of America, without strict reference to either political or geographical boundaries, they stand in relation to the number of species of Humming Birds which they possess about as follows: First, Ecuador, with considerably more than 100, closely followed by Colombia, with about 100 species; next, Peru and Bolivia together, with about 96; third, Central America (from Veragua to Guatemala, inclusive), with about 70; fourth, Brazil, with a little over 60, though many of these belong to the region of the Amazon basin, and therefore are not properly Brazilian; fifth, Venezuela (including the islands of Trinidad and Tobago), with between 50 and 60 species; sixth, Mexico, with about 50; seventh, Guiana, with about 30; eighth the West Indies, with less than 20; ninth, the United States, with 17, of which all but 8 barely come across the boundary from Mexico, and therefore should hardly be counted; tenth, the southern extremity of South America (including Chili and the greater part of the Argentine Republic), where only about 7 occur, and 2 of these merely as intruders from the warmer regions to the northward. In North America no Humming Bird is known to occur beyond the parallel of 61 degrees, the Rufous Humming Bird (*Selasphorus rufus*) reaching that latitude on the Pacific coast, while on the eastern side the Ruby-throat (*Trochilus colubris*) has been traced to 57 degrees north latitude.

The geographical distribution of Humming Birds is a matter of great interest, some of them being of widely extended range, while others are confined to single mountain peaks or valleys. But owing to the careless manner in which many authors state the range of species, it is at present impossible to express with more than approximate correctness the comparative richness of different countries or faunal provinces in their representation of these birds. Even some of our standard authorities are content to say "Brazil," "Central America," or "Mexico" when giving the habitat of a species, apparently ignorant of the fact, or at least quite ignoring it, that it makes all the difference in the world what particular part of those extensive countries the species in question may inhabit. Thus, the political boundaries of Brazil include not only the Brazilian faunal province, but a considerable portion of the Amazonian province, each with several more or less distinct subdivisions, while Central America includes two quite distinct subprovinces, composed of the republics of Costa Rica and Nicaragua on the one hand, and the greater part of Guatemala, Salvador, and Honduras on the other, though just where the two subprovinces merge together we do not yet know. That political areas do not by any means correspond with faunal areas is an important fact which should be constantly borne in mind by the collector as well as by the compiler; for, until our knowledge of the range of each species within a given country is far more complete than it is at the present time, we cannot sketch the geographical distribution of these birds, as a group, with any degree of accuracy. In order to fully appreciate this difficulty, it is only necessary for one to understand that when the range of a species is said to be "Brazil" (as in even the best of books on the subject), no one can tell whether it belongs to the true Brazilian or the Amazonian province, since both are chiefly included within the area of the country known politically as Brazil, though zoölogically they are far more distant from one another than is North America from Europe or the latter from temperate Asia! The true Brazilian Province, moreover, includes, besides a large portion of Brazil itself, the politically distinct countries of Paraguay and Uruguay, together with adjoining portions of the Argentine Republic and Bolivia.

Authorities on the subject of geographical distribution of animals differ as to the relative value or importance of these faunal divisions; but there is little difference of opinion as to their number and approximate boundaries. Beginning at the south and proceeding, irregularly, northward, they are as follows:

I. The Patagonian or Chilian Province, embracing Tierra del Fuego, Falkland Islands, Chili, Patagonia, the greater part of the Argentine Republic, and the southeast portion of Bolivia.

II. The South-Brazilian Province, comprising all of Brazil south of the Amazon basin, the whole of Uruguay and Paraguay, and the northeast portion of the Argentine Republic.

III. The Amazonian Province, including, besides the entire Amazon basin (below a certain altitude upon the head streams), all of Guiana, that portion of Venezuela south of the Orinoco, the Amazon watershed of Bolivia, the northeast corner of Peru, and the eastern part of Ecuador and Colombia.

IV. The Colombian Province, comprising the central and littoral districts of Colombia, Venezuela north of the Orinoco (including the Islands of Trinidad and Tobago), central and western Ecuador, the whole of Peru except the northeast corner and the higher Andean summits, and a part of western and southwestern Bolivia.

V. The Central American Province, embracing that portion of the continent from the Isthmus of Panama northward to southern Mexico, where the so-called Neotropical Region merges into the so-called Nearctic Region.

VI. The West Indian Province, which embraces the whole of the Antillean archipelago, from the Bahamas southwards, but *not* including either Tobago or Trinidad.

For the present purpose, however, it will be more practicable to combine III and IV into one "province," which for convenience may be termed the Colombo-Amazonian, and extend its limits to the northward to include the entire isthmus as far as the coast region of Mexico, thus restricting the Mexican Province to the plateau region and higher lands for an undetermined distance southward, probably not farther than the highlands of Guatemala, Honduras, and northern Nicaragua, but possibly including the higher summits of Costa Rica, where a considerable number of northern types occur.*

Of all these "provinces" the composite one, which I have termed the Colombo-Amazonian, is incomparably the richest in bird life of any region of the earth; and it is therefore not strange that nearly one-half of all the known species of Humming Birds should be peculiar to its territory. The next in comparative richness in birds of this family is probably the Mexican, in its comprehensive sense, for owing to the carelessness of authors in designating localities it is at present impracticable to separate the species which properly belong to this province from those belonging to the northern extension of the preceding one. Of the 93 species and 23 genera peculiar to the country north of the Isthmus of Panama, about 55 species and 14 genera do not occur south of Gautemala or Honduras. The Brazilian Province probably comes next in number of peculiar species, but it is at present impossible to tell just how many should be credited to it, a very considerable proportion of the 38 species whose range is given as "Brazil" undoubtedly belonging to Colombo-Amazonian Province. From the comparatively small number of Humming Birds peculiar to the Brazilian Province there is a decided falling off in those of the West Indian Province, where we are able to count only 18 peculiar species; but this number seems large compared with the showing made by the two most widely separated and coldest provinces, the North American and the Chilian, which have only 8 and 5 species, respectively, of Humming Birds peculiar to them.

The grand centre or focus of the family of Humming Birds is that portion of the Colombo-Amazonian Province comprised within the limits of the State of Ecuador, where considerably more than 100 species occur (more than one-fifth of all that are known), more than half of them occurring nowhere else. Colombia is nearly as rich, having about 100 species, nearly 50 of which are peculiar. Peru and Bolivia together (included within the southwestern portion of the same province) possess about 90 species, of which more than half are peculiar. Northward and northeastward from the "focal center" the number of species diminishes gradually, Central America (including Guatemala) having about 70 species (40 peculiar), Mexico, alone, about 50 (28 peculiar), Venezuela, (including Trinidad and Tobago) between 50 and 60 (15 peculiar), Guiana about 36 (12 peculiar), and the West Indies with only 18 (*all of them peculiar*).

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*For example, among Humming Birds four species of the genus *Selasphorus* and one each of *Eugenes*, *Doricha*, *Eupherusa*, and *Cœligena*, and others related to or identical with more northern forms. It is true a much larger number of southern types occur in the same country, but they are mainly restricted to lower and therefore more tropical elevations.

On the other hand, the decrease to the southeastward from the "focal center" in the true Brazilian Province is very great; it is impossible, at present, to properly estimate the total number of species found there, but it is probably considerably less than 50, with, however, perhaps more than half of them peculiar.

### MIGRATIONS.

While in tropical regions the Humming Birds are, like other kinds, permanent residents, or at most make comparatively slight migrations when the food supply of a given locality fails them, or when, on high mountains, the increasing cold forces them to descend to the warmer slopes and valleys, those of temperate regions make extensive and regular migrations like other birds of the same regions, coming from the south in spring and returning in autumn. Thus, the common Ruby-throated Humming Bird (*Trochilus colubris*) has its summer home in eastern North America, where it occupies the extensive region stretching from the Gulf of Mexico to half way across the British Provinces (at least to latitude 57 degrees north), and from the Atlantic coast to beyond the Mississippi. It breeds throughout this area, but is not known to do so south of the United States. In winter, however, its range is shifted far to the southward, the northern recorded limit at that season being southern Florida (Punta Rassa, latitude about 29 degrees), and the southern limit in Veragua, the western portion of the Isthmus of Panama, only about 8 degrees north of the equator. It is thus evident that, notwithstanding their diminutive size, some individuals of this species perform an annual migration of at least 28 degrees of latitude, equivalent to nearly 2,000 statute miles! On the opposite side of the continent the highest latitude attained is about that of 61 degrees, on the coast of Alaska, where the Rufous-backed Humming Bird was found by Kotzebue. The same species winters in Mexico, so that in their migrations those individuals which pass the summer farthest north traverse considerably more than 2,000 miles of territory! It is only in the warm valleys of California and in southern Florida that any species of Humming Bird regularly passes the winter within the borders of the United States; in the former the Anna Humming Bird (*Calypte anna*), and in the latter the Ruby-throat (*Trochilus colubris*). All the species of western North America (including many individuals of *C. anna*) winter in Mexico, only one of the truly northern species (*Selasphorus platycercus*) extending its winter range as far as Guatemala.

The vertical range of some species in mountain districts is quite remarkable. In July, 1868, the writer observed examples of *Selasphorus platycercus* in the dooryard of a ranch in Ruby Valley, Nevada, the altitude being between 6,000 and 7,000 feet, and later during the same day saw a single individual of the same species at the extreme summit of the immediately adjacent East Humboldt Mountains, nearly 6,000 feet higher.

## HABITS.

The general habits of Humming Birds are in most respects similar to those of other birds. They are both arboreal and aërial, but are unable to progress upon the ground, or any flat surface, by means of their legs and feet alone. They perch frequently upon trees or bushes, or even in rare instances cling to rocks; and their mode of nidification presents nothing that may be deemed peculiar or even specially characteristic. In their flight and manner of procuring their food, however, they differ strikingly from other birds, in these respects much more closely resembling certain insects than any of the "feathered tribe."

Says Prof. Alfred Newton:

> Wilson, Audubon, Mr. Gosse, and several others, gifted with the "pen of a ready writer," have so fully described, as far as words will admit, the habits of different members of the family *Trochilidæ* that it is unnecessary to say much upon this score. Their appearance is so entirely unlike that of any other birds that it is hopeless to attempt in any way to bring a just conception of it to the ideas of those who have not crossed the Atlantic; and even the comparison so often made between them and the *Sphingidæ*, though doubtless in the main true, is much to the advantage of the latter. One is admiring the clustering stars of a scarlet *Cordia*, the snowy cornucopias of a *Portlandia*, or some other brilliant and beautiful flower, when between the blossom and one's eye suddenly appears a small dark object, suspended, as it were, between four short black threads meeting each other in a cross. For an instant it shows in front of the flower; an instant more it steadies itself, and one perceives the space between each pair of threads occupied by a gray film; again, another instant, and, emitting a momentary flash of emerald and sapphire light, it is vanishing, lessening in the distance as it shoots away to a speck that the eye can not take note of, and all this so rapidly that the word on one's lips is still unspoken, scarcely the thought in one's mind changed. It was a bold man or an ignorant one who first ventured to depict Humming Birds flying; but it can not be denied that representations of them in that attitude are often of special use to the ornithologist. The peculiar action of one, and probably of many or all other species of the family, is such that at times, in flying, it makes the wings almost meet, both in front and behind, at each vibration. Thus, when a bird chances to enter a room it will generally go buzzing along the cornice; standing beneath where it is, one will find that the axis of the body is vertical, and each wing is describing a nearly perfect semicircle. As might be expected, the pectoral muscles are very large; indeed, the sternum of this bird is a good deal bigger than that of the common Chimney-Swallow (*Hirundo rustica*, L.) But the extraordinary rapidity with which the vibrations are effected seems to be chiefly caused by these powerful muscles acting on the very short wing-bones, which are not half the length of the same parts in the Swallow; and accordingly, great as this alar action is, and in spite of the contrary opinion entertained by Mr. Gosse (Nat. Sojourn in Jamaica, p. 240), it is yet sometimes wanting in power, owing doubtless to the disadvantageous leverage thus obtained; and the old authors must be credited who speak of cobwebs catching Humming Birds.

Among the multitude of forms which compose this extensive family of birds there must necessarily be some which depart, more or less, in certain particulars as regards their habits, from the more typical kinds; but so far as their habits have been recorded, I have been able to find only one example of unusual or extraordinary peculiarity in this respect, namely, the curious habit of the Pichincha Hill-star (*Oreotrochilus* *pichincha*) of clinging to the vertical or overhanging surface of bare rocks, thus described by Mr. L. Fraser:*

> I observed three specimens of this bird, all of a row, hanging to the bare rock (this now explains the use of those large feet and claws which the species of this group have, and which has hitherto puzzled me) like Sand-martins; it was under a ledge, well protected from the weather, consequently well adapted by nature for nest-building. (They would fly away and then return; this was done in my sight three or four times in succession.) On examining the spot, which was almost inaccessible, I found much excrement, proving to my mind that they breed in societies. My countryman, Colonel Stacey, on a visit to this mountain, happened to have on a new bright yellow oil-skin cover to his wide-awake hat, and one of these birds flew round and round it for a considerable time, as he supposes, mistaking it for a flower.

### ABUNDANCE OF INDIVIDUALS.

In regions where several species occur, Humming Birds are often as numerous as bees about the flowers; but in the eastern portion of North America, where, even in Florida, only one kind is found, they are seldom seen in any considerable numbers, though during the period of flowering of some bush or tree the blossoms of which they are specially fond of (as for example the Black Locust, *Robinia pseudacacia*), one may, under the most favorable circumstances, see scores of them in different parts of the same tree. In the more southern portion of the western United States, however, where several species often occur together, they are far more numerous, on occasions fairly swarming in their favorite localities. Referring to Humming Birds observed at one of his camps in the mountains of New Mexico, near the headwaters of the Pecos River, Mr. Henshaw writes as follows: †

> The number of representatives of this [the Rufous Hummer, *Selasphorus rufus*] and the preceding species [the Broad-tailed Hummer, *S. platycercus*] that make their summer homes in these mountains is simply beyond calculation. No one whose experience is limited to the eastern United States can form any adequate idea of their abundance. They occur from an altitude of about 7,500 feet far up on the mountain sides, as high up, in fact, as suitable flowers afford them the means of subsistence. They are most numerous at an altitude of from 8,000 to 9,000 feet. During the entire summer they frequent almost exclusively a species of *Scrophularia* which grows in clumps in the sunnier spots of the valleys. From early dawn till dusk the Humming Birds throng around these plants intent in surfeiting themselves on honey and the minute insects that the honey attracts. The scene presented in one of these flowering areas is a most attractive one. * * *
>
> Some idea of the number of Humming Birds in this locality—and in this respect this whole mountain area is alike—may be gained from the statement that in a single clump of the *Scrophularia* I have counted eighteen Hummers, all within reach of an ordinary fishing rod. There was scarcely a moment in the day when upwards of fifty could not be counted within the area of a few yards in any of the patches of this common plant.

At Apache, Arizona, in the month of August, Mr. Henshaw found the same species, "literally by hundreds, hovering over the beds of brightly-tinted flowers, which in the mountains especially grow in the greatest profusion on the borders of the mountain streams."* In the Catalina Mountains of Arizona, in August and September, Mr. W. E. D. Scott found it "very abundant, feeding on thistles and a kind of scarlet flower very similar to the Salvia or Scarlet Sage," it being "no uncommon sight to see from twenty to fifty of the birds at once;" and in the valley of the Truckee River, near Pyramid Lake, Nevada, I found them equally numerous among the sunflowers which grew in patches in the river bottoms.

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* In Proceedings of the Zoological Society of London, 1860, p. 80.

† The Auk, vol. III, 1886, pp. 76–78.

In the tropical regions, where, instead of one or at most three or four species, dozens of kinds inhabit the same district the abundance of individuals is frequently amazing to one unused to such sights.

Says Mr. Waterton:

> Cayenne and Demerara produce the same Humming Birds. Perhaps you would wish to know something of their haunts. Chiefly in the months of July and August the tree called Bois Immortel, very common in Demerara, bears abundance of blossoms which stay on the tree for some weeks; then it is that most of the species of Humming Birds are very plentiful. The wild Red Sage (*Salvia splendens*) is also their favorite shrub; and they buzz like bees round the blossoms of the Wallaba tree; indeed, there is scarcely a flower in the interior or on the seacoast but what receives frequent visits from one or other of the species.
>
> On entering the forests of the rising land in the interior, the blue and green, the smallest brown, no bigger than the humblebee, with two long feathers in the tail, and the little forked-tail purple-throated Humming Birds glitter before you in ever-changing attitudes.
>
> As you advance towards the mountains of Demerara other species of Humming Birds present themselves before you.

The Humming Birds of Jamaica are not as numerous in species as those of California (there are only three species), but they appear to make up for this deficiency by abundance of individuals.

> I can not quit the subject [says the Rev. Lansdown Guilding] without speaking of the delight that was afforded me in Jamaica by seeing Humming Birds feeding on honey in the florets of the great Aloe (*Agàve americana*, Linn.). On the side of a hill upon Sutton's estate (the property of Henry Dawkins, esq.) were a considerable number of aloe plants, of which about a dozen were in full blossom. They were spread over a space of about 20 yards square. The spikes, bearing bunches of flowers in a thyrsus, were from 12 to 15 feet high; on each spike were many hundred flowers of a bright yellow color, each floret of a tubular shape and containing a good-sized drop of honey. Such an assemblage of floral splendor was in itself most magnificent and striking; but it may be imagined how much the interest caused by this beautiful exhibition was increased by vast numbers of Humming Birds, of various species, fluttering at the opening of the flowers, and dipping their bills first into one floret and then into another, the sun, as usual, shining bright upon their varied and beautiful plumage. The long-tailed or Bird-of-Paradise Humming Bird was particularly striking, its long feathers waving as it darted from one flower to another. I was so much delighted with this sight that I visited the spot again in the afternoon, after a very long and fatiguing day's ride, accompanied by my wife, on horseback, when we enjoyed the scene before us for more than half an hour.

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* Report of Ornithological Collections, Wheeler's Expedition, p. 131.

## ACTIONS AND ATTITUDES.

Humming Birds are so distinct from other birds in their external structure and manner of flight that they present in every respect, except when at rest, an appearance entirely peculiar to themselves. They spend perhaps the greater part of their time upon the wing, usually hovering or balancing themselves before a flower from which they are procuring their sustenance of honey or minute insects. At such time the body is nearly vertical or inclined at a slight angle, the head bent nearly at right angles with the axis of the body, the wings spread nearly at right angles with the same axis, but vibrated so rapidly that they are visible only as an indistinct haze on each side of the body of the bird. While in this position the tail is spread, and with it the bird largely regulates its distance from the flower by flirting the tail forward, or the reverse, when it wishes to recede or advance, respectively.

While resting they usually select a slender dead twig, in a prominent or exposed portion of a bush or tree, where they sit in a nearly vertical position, with head drawn down and feathers of the throat puffed outward, something in the manner of swallows. The wings usually if not invariably drop *beneath* the generally unspread tail. They are fond of preening their plumage, and thus afford a variety of graceful attitudes for showing off particular parts of the plumage to advantage. Mr. Audubon observes that they are particularly fond of spreading one wing at a time and passing each of the quill feathers through their bill in its whole length, when, if the sun is shining, the wing thus plumed is rendered extremely transparent and light. Mr. Audubon also observes that when perching "they move sidewise in prettily measured steps, frequently opening and closing their wings, pluming, stroking, and arranging the whole of their apparel with neatness and activity."

Comparatively few persons have had the opportunity to observe the actions of the female Humming Bird when setting on her nest or when maneuvering in its immediate vicinity. The following account of the actions of a female Ruby-throat (*Trochilus colubris*) will therefore probably be of special interest:

> Although I spent several hours watching this nest, on different occasions, no food was brought at such times, but the actions of the female, as seen through a strong field glass at short range, were decidedly interesting. The approach to the nest was as usually described in about one-third of the records—*i. e.*, directly to a point over and close to the nest, then dropping lightly into it. The general method, however, was by a dashing flight to within 12 or 15 feet, a sudden pause while poised in the air, anxiously looking about her, then 1 or 2 feet further, another pause with the same maneuvers, to be repeated until at last she dropped into the nest as ordinarily. This entire procedure occupied less than 10 seconds. A few times she seemed to fly directly *into* the nest without any preliminaries.
>
> Just after settling in the nest she had a habit of occasionally completely turning around in it one or more times. This was a hitching motion, as if by the use of her feet, meanwhile appearing to rearrange the material on the outside and as if shaping the interior to her better satisfaction by this treading motion. At other times, spread-

ing her wings over the nest in a seeming ecstacy of delight, she rather flutteringly turned around in it, apparently without regard for its precious contents.

There seemed to be one never varying position when at rest, that facing the more open part of the grove, the usual direction of approach being from behind, whereas the flight from the nest was toward the clearer space in front. The sitting posture was not one of absolute rest at any time, as the head was constantly in motion, so that no approach could be made without her knowledge. The flight from the nest seemed to be directly out of it, without any preliminaries. The weather was warm, yet she would remain on the nest from 15 to 20 minutes, and in no instance was away more than 2 minutes while I had her under observation. The male frequently appeared in the vicinity, but neither offered food nor even deigned to alight on the same tree, yet birds which had a good claim in the neighborhood dared not approach very close, as the combined at tack of these active birds always proved so distasteful that they invariably beat a hasty retreat.*

## MANNER OF FLIGHT.

The extraordinary development of the pectoral muscles in the Humming Birds and its purpose is made a special topic on pages 292, 293; but a preliminary description of the motion imparted to the wings by these powerful engines, if such they may be styled, and other particulars relating to the flight of Humming Birds, may be given here. As birds differ from all other animals in the possession of feathers, so do Humming Birds differ from all other birds in their manner of flight, which, as Mr. Gosse truly says, is entirely that of an insect, especially a large beetle or a bee. "To me," says Mr. Gould, "their actions appeared unlike anything of the kind I had ever seen before, and strongly reminded me of a piece of machinery acted upon by a powerful spring. I was particularly struck by this peculiarity in the flight, as it was exactly the opposite of what I expected. The bird does not usually glide through the air with the quick, darting flight of a Swallow or Swift, but continues tremulously moving its wings while passing from flower to flower, or when taking a more distant flight over a high tree or across a river. When poised before any object this action is so rapidly performed that it is impossible for the eye to follow each stroke, and a hazy semicircle of indistinctness on each side of the bird is all that is perceptible. †

The wind produced by this rapid vibration of the wings is very considerable, Mr. Salvin having noticed that while a Humming Bird which had flown into a room was hovering over a large piece of wool, the entire surface of the wool was violently agitated.

Probably no one has ever observed the actions of Humming Birds with greater care than Mr. Gould, whose enthusiastic interest in them must naturally have reached its culminating point when he first beheld living specimens in the full freedom of their native haunts. He thus tersely describes their flight:

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* Edwin H. Eames, in "The Auk," July, 1890, pp. 287, 288.

† According to Mr. Gosse ("Birds of Jamaica," p. 133), the vibration of each wing in the *Mellisuga minima* reaches nearly or quite 180 degrees. In several of the plates of the present work the artists have attempted to depict the appearance of the wings during flight—the birds being represented in the attitude of poising over the nest. (See plates XLI and XLII. The appearance of the extended wings in plates XLIII and XLIV is, of course, incorrect, the object being to show the form of the wing and arrangement of its feathers.)

> Although many short intermissions of rest are taken during the day, the bird may be said to live in air—an element in which it performs every kind of evolution with the utmost ease, frequently rising perpendicularly, flying backward, pirouetting or dancing off, as it were.

Regarding the ability of the Humming Bird to fly backward, we quote the following, by Bradford Terrey, from Science, vol. II, No. 34, p. 436:

> The Duke of Argyle, in his Reign of Law (p. 145), lays it down in italics, that "*no bird can ever fly backwards.*" He mentions the Humming Bird as appearing to do so, but maintains that in reality it falls rather than flies, when, for instance, he comes out of a tubular flower. But this morning while watching the motions of a Humming Bird (*Trochilus colubris*), it occurred to me to test the *dictum* of the duke, and unless my eyes were altogether at fault, the bird did actually fly backwards. He was probing, one after another, the blossoms of a petunia bed, and more than once, when the flower happened to be low down, he plainly rose rather than fell as he backed away from it.

The present writer has observed the same thing, but has noticed that the backward motion is greatly assisted by a forward flirt of the expanded tail as the bird shifts from place to place, or from one part of a tree to another, sometimes descending, at others ascending. It often towers up above the trees, and then shoots off like a little meteor at a right angle; at other times it quietly buzzes away among the flowers near the ground; at one moment it is poised over a diminutive weed, at the next it is seen at a distance of 40 yards, whither it has vanished with the quickness of thought. During the heat of the day the shady retreats beneath the trees are very frequently visited; in the morning and evening the sunny banks, the verandas, and other exposed situations are more frequently resorted to.

"All the Humming Birds," says Mr. Gosse, "have more or less the habit when in flight of pausing in the air, and throwing the body and tail into rapid and odd cortortions; this seems to be mostly the case with the Mango (*Lampornis mango*), but perhaps is more observable in Polytmus from the effect that such motions have on the beautiful long feathers of the tail. That the object of these quick turns is the capture of insects I am sure, having watched one thus engaged pretty close to me. I drew up and observed it carefully and distinctly saw the minute flies in the air, which it pursued and caught, and heard repeatedly the snapping of the beak. My presence scarcely disturbed it, if at all."

That there are exceptions to the manner of flight which we have described, is true, but they probably are not numerous. One of the most notable is that of the Giant Humming Bird (*Patagona gigas*) of the Andes, which, Darwin says, whilst hovering over a flower flaps its wings with a very slow and powerful movement, totally different from that vibratory one common to most of the species, which produces the humming noise. He "never saw any other bird where the force of its wings appeared (as in a butterfly) so powerful in proportion to the weight of its body. When hovering by a flower, its tail is constantly expanded and shut like a fan, the body being kept in a nearly vertical position." Mr. Darwin does not say whether any sound is produced by the wings of this species; but I am informed by Mr. W. E. Safford, U. S. Navy, who has frequently observed them, that the flight of the Giant Humming Bird is as noiseless as that of a butterfly.

Those Humming Birds, with elongated spatule-tipped tail feathers are to a degree peculiar in their flight, although the motion of the wings themselves is essentially the same as in ordinary kinds. The late Mr. Dyson informed Mr. Gould that the flight of these Racquet-tailed Hummers is very peculiar, and that their appearance in the air is most singular; the tail being not only constantly opened and shut, but the spatules always in motion, particularly when the bird is poising over a flower.

Although the muffled buzzing or humming noise, which has given this family of birds its distinctive name is the sound usually accompanying the flight of Humming Birds, the males of some species accompany their flight with a most remarkable noise, of an entirely different character. While among the mountains of Utah, in 1869, the writer was for a long time mystified by a shrill screeching noise, something like that produced by a rapidly revolving circular saw when rubbed by a splinter. This noise was evidently in the air, but I could not discover its origin, until I discovered a Humming Bird passing through the air overhead in a curious undulating line of flight. I afterwards heard the same sound produced by males of the same species (the Broad-tailed Humming Bird, *Selasphorus platycercus*), when they were driving other birds away from the vicinity of their nests. At such times they would ascend almost perpendicularly to a considerable height, and then descend with the quickness of a flash at the object of their animosity, which was perhaps more frightened or annoyed by the accompanying noise than by the attack itself.

Mr. F. Stephens,* calls this the "courtship song," but from the circumstance that, in the Broad-tailed Humming Bird at least, it is often produced by solitary individuals while wending their way between distant points, I hardly think it can properly be so considered. Writing of Costa's Humming Bird (*Calypte costæ*), he says:

> The female is sitting on a twig in a low bush, not on an exposed twig as is often the case when she is merely resting, but when the male begins she goes further in, as if she feared that he really intended mischief, while he rises high in the air, and, with a headlong swoop, comes down, passing her, and turning with a sharp curve as near her as is possible mounts on high to repeat the maneuver again and again. A shrill whistle is heard as he begins to descend, starting low and becoming louder and louder, until as he passes her it becomes a shriek which is plainly audible for a distance of 100 yards or more. As he mounts again it dies away only to be repeated

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* Bulletin of the Ridgway Ornithological Club of Chicago, No. 2, 1887, pp. 44, 45.

at the next descent. This is a common maneuver with the species. The whistle made during the descent was quite low and the buzzing sound made as he passed the other bird, a young *T. costæ*, was coarser than I had heretofore thought. It also lacked all whistling character. I also noticed another swooping back and forth, but heard no whistle or other vocal sound.

Mr. Henshaw* also is inclined to think that this sound, in the Broad-tailed Hummer (*Selasphorus platycercus*), at least, is "analogous to the love-notes of other birds." Says he:

During the mating, and perhaps also through the entire breeding season, the flight of the male is always accompanied by a curious, loud, metallic, rattling noise, which he is enabled to produce in some way by means of the attenuation of the outer primaries. This is, I think, intentionally made, and is analogous to the love notes of other birds. Though I saw many of these birds in the fall, it was only very rarely that this whistling noise was heard, and then with greatly diminished force.

## DISPOSITION.

In their disposition Humming Birds are not only very tame but highly curious or inquisitive, and exhibit a special propensity to closely inspect a human intruder to their domains. One of these little feathered fairies will at such times approach like a flash and poise directly before one's face, its wings vibrating so rapidly as to appear as a mere haze on each side of its body, which itself remains so stationary that the inquiring expression of its bright black eyes and the outline of nearly every feather of its compact little figure can be seen; then it shifts rapidly to one side, then to the other, and approaches so near as to be easily within reach of the hand; but the slightest demonstration causes it to vanish so swiftly that the eye can scarcely trace the line of its flight.

The charming confidence in the human species shown by Humming Birds when they are treated considerately is well illustrated by an anecdote related by Lady Emeline Stuart Wortley in her "Travels." A pair of the minute Vervain Hummer (*Mellisuga minima*) had built their nest close to one of the walks of the garden of the place where she was staying.

The branch, indeed, of the beautiful shrub in which this fairy nest was suspended almost intruded into the walk; and every time we sauntered by there was much danger of sweeping against this projecting branch with its precious charge and doing it some injury, as very little would have demolished the exquisite fabric. In process of time two lovely pea-like eggs had appeared; and while we were there we had the great pleasure of seeing the minute living gems themselves appear, looking like two very small bees. The mother bird allowed us to look closely at her in the nest and inspect her little nurslings, when she was flying about near, without appearing in the least degree disconcerted or alarmed. I never saw so tame or so bold a pet. But she did not allow the same liberties to be taken by everybody unchecked. One day, as Sir C—— was walking in the pretty path beside which the fragile nest was delicately suspended amid sheltering leaves, he paused in order to look at the lilliputian inhabitants. While thus engaged he felt suddenly a sharp light rapping on the crown of his hat, which considerably surprised him. He looked round to ascertain from whence the singular and unexpected attack proceeded; but nothing was to be seen. Almost thinking he must have been mistaken, he continued his survey, when a much sharper and louder tat-tat-tat-tat-tat seemed to demand his immediate attention, and a little to jeopardize the perfect integrity and preservation of the fabric in question. Again he looked round, far from pleased at such extraordinary impertinence, when what should he see but the beautiful, delicate Humming Bird, with ruffled feathers and fiery eyes, who seemed by no means inclined to let him off without a further infliction of sharp taps and admonitory raps from her fairy beak. She looked like a little fury in miniature—a winged Xantippe. Those pointed attentions apprised him that his company was not desired or acceptable; and, much amused at the excessive boldness of the dauntless little owner of the exquisite nest he had been contemplating, Sir C—— moved off, anxious not to disturb or irritate further this valiant minute mother, who displayed such intrepidity and cool determination. As to V—— and me, the darling little pet did not mind us in the least; she allowed us to watch her to our heart's content during the uninterrupted progress of all her little household and domestic arrangements, and rather appeared to like our society than not, and to have the air of saying, "Do you think I manage it well, eh?"

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* Report on Ornithological Specimens, Wheeler's Expedition, p. 88.

The following account* of the taming of wild Humming Birds also shows how easily, with a little pains, these lovely creatures can be tamed:

A lady residing at San Rafael, one of the many pleasant health resorts of California, has sent to friends in London an account of the taming of two wild Humming Birds by her daughter, who, under medical direction, has for some months passed several hours daily reclining on rugs spread on the garden lawn. "E. has a new source of interest," her mother writes. "The humming birds have claimed her companionship and manifested their curiosity by inspecting her, with their little wise heads turned to one side, at a safe distance, watching her movements, evidently wishing to become acquainted. To entice them to a nearer approach, E. plucked a fuchsia, attached it to a branch of a tree over her head, and filled it with sweetened water. The intelligent little creatures soon had their slender bills thrust into the flower, from which they took long draughts. Then E. took honey, thinking they might prefer it, and filled a fresh flower each day. They would sometimes become so impatient as scarcely to wait for her to leave before they were into the sweets, and, finally, while she held a flower in one hand and filled it with drops from a spoon, the now tame little pets would catch the drops as they fell, and dart into the honey cup their silvery, thread-like tongues. E. is delighted, and so fascinated with them that she passes hours each day of her resting time talking to them and watching their quick, lively movements. Although these tiny birds are humming all day among the flowers, two only have monopolized the honey-filled flower, and these are both males, consequently there are constant squabbles as to which shall take possession. They will not permit a wasp or a bee to come near their honey flower, and not only drive them away, but chase them some distance, uttering a shrill note of protest against all intruders." Referring to them again, at the close of the rainless California summer, in a letter dated October 26, this lady writes: "We have had threatening clouds for two days and a heavy rainfall to-day. E. has continued her devotion to her little Humming Birds. Since the change of weather she has tried to coax them to the parlor windows. They appeared to think there must be some mistake, and would hum about the window where she stood with the honey flower and spoonful of honey, or they would sit on a branch and watch every movement, yet not daring to take a sip until to-day, when at her peculiar call, which they always recognize, one ventured repeatedly to take the honey from her hand.

Though so readily accustomed to the society of human beings, Humming Birds do not, unfortunately, long survive confinement. Whether

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[*] Taken from the "Scientific American."

it is the want of sufficient exercise, or some other unknown cause, they invariably die within a few weeks, or months at the longest, of their capture. The first attempt to transport them alive across the Atlantic seems to be the one related by Latham, as follows:

> "A young gentleman, a few days before he sailed from Jamaica for England, met with a female Humming Bird sitting on the nest and eggs, and cutting off the twig, he brought altogether on board. The bird became sufficiently tame to suffer herself to be fed on honey and water during the passage, and hatched two young ones. The mother, however, did not long survive, but the young were brought to England, and continued for some time in the possession of Lady Hammond. The little creatures readily took honey from the lips of Lady Hammond, and though the one did not live long, the other survived for at least two months from the time of their arrival."

Mr. Gould was partially successful in his attempt to carry living specimens of the Ruby-throat (*Trochilus colubris*) to England, his experience being related as follows:

> "A *Trochilus colubris* captured for me by some friends in Washington . . . immediately afterwards partook of some saccharine food that was presented to it, and in 2 hours it pumped the fluid out of a little bottle whenever I offered it; and in this way it lived with me a constant companion for several days, traveling in a little thin, gauzy bag distended by a slender piece of whale bone and suspended to a button of my coat. It was only necessary for me to take the little bottle from my pocket to induce it to thrust its spiny bill through the gauze, protrude its lengthened tongue down the neck of the bottle, and pump up the fluid until it was satiated; it would then retire to the bottom of its little home, preen its wings and tail-feathers, and seem quite content.
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> The specimens I brought alive to this country were as docile and fearless as a great moth or any other insect would be under similar treatment. The little cage in which they lived was 12 inches long by 7 inches wide and 8 inches high. In this was placed a diminutive twig of a tree, and, suspended to the side, a glass vial which I daily supplied with saccharine matter in the form of sugar or honey and water, with the addition of the yolk of an unboiled egg. Upon this food they appeared to thrive and be happy during the voyage along the seaboard of America and across the Atlantic, until they arrived within the influence of the climate of Europe. Off the western part of Ireland symptoms of drooping unmistakably exhibited themselves; but, although they never fully rallied, I, as before stated, succeeded in bringing one of them alive to London, where it died on the second day after its arrival at my house. The vessel in which I made the passage took a northerly course, which carried us over the banks of Newfoundland, and, although the cold was rather severe during part of the time, the only effect it appeared to have upon my little pets was to induce a kind of torpidity from which, however, they were readily aroused by placing them in the sunshine or in some warm situation, such as before a fire, in the bosom, etc. I do assure my readers that I have seen these birds cold and stiff, and to all appearances dead, and from this state they were readily restored by a little attention and removed into light and heat, when they would "perk up," flutter their little wings, and feast away upon their usual food as if in the best state of health.

The experience of Mr. Gosse in his attempt to domesticate the beautiful Long-tailed Humming Bird of Jamaica (*Aithurus polytmus*) was equally discouraging.

> Some [says he] were taken with the net, others with birdlime, but though transferred to a basket or to a cage immediately on capture, not a few were found dead on arrival at home. This sudden death I could not at all account for; they did not

> beat themselves against the sides, though they frequently clung to them. From the wild look of several that were alive when arrived, sitting on the bottom of the cage looking upward, I suspect terror at their capture and novel position had no small influence. Many of those which were found alive were in a dying state, and of those which were turned out into the room several more died in the first 24 hours, generally because, not observing the lines which the domesticated ones used as perches, they would fly against the perpendicular walls, where, after fluttering awhile suspended, they would at length sink exhausted perpendicularly downwards, the wings still vibrating, and alight on the object that intercepted their downward course. If this was the floor they would presently rise on the wing, only again to flutter against the wall as before; but often it would happen that they would sink behind some of the many boxes with which the shelves were lumbered, in which case, the space being too narrow for the use of their wings, they soon died unobserved, and were found dead only upon searching. This was the fate of many, so that out of the 25 only 7 were domesticated. These, however, became quite at home; and I may here observe that there was much difference in the tempers of individuals, some being moody and sulky, others very timid, and others gentle and confiding from the first. I have noticed this in other birds also.

Those which survived the longest, however, finally died, and the cause of their death he conjectured to have been the want of insect food, and that, notwithstanding their frequent sipping at the syrup they were really starved to death. He was led to this conclusion by having found, on dissecting those which died, that they were excessively meagre in flesh, and that the stomach, which ordinarily is as large as a pea, and distended with insects, was in these shrunken to a minute collapsed membrane.

Notwithstanding their diminutive size, pugnacity is one of the most conspicuous traits of Humming Birds. Particularly is this true of the male during the breeding season, when not only are others of the same species which imprudently approach the vicinity of his nest promptly attacked and driven away, but other and much larger birds also; even King Birds and the boldest hawks beat a precipitate retreat before the impetuous assaults of the tiny warrior, whose boldness is only equalled by the lightning-like rapidity of his movements, thus baffling any attempt at resistance on the part of the more powerful adversary. Intruders of the human species are not, under such circumstances, always exempt from his vehement attacks, but oftener, perhaps, the little champion is content with mere "skirmishing" demonstrations.

It is not only when defending their nest or young that Humming Birds display this combative spirit, nor is it confined to the male alone; for, when two or more individuals, of either sex, happen near the same spot, spirited and often violent conflicts are almost certain to ensue. Such a contest is very accurately and graphically described by a writer in "Forest and Stream"* as follows:

> I was walking along one of the streets of this village, and passed by a flower garden where a large bed or bush of salvia grew against the front palings. The plant or plants was filled with a great profusion of bright red flowers, some of which reached

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* "Coaboma," in the issue of October 24, 1889. The species is the common Rubythroat, and the locality Cambridge, Mississippi.

above the fence. Hovering over these were two Humming Birds whose coats of metallic sheen glistened in the sun like burnished gold and silver. The little creatures darted hither and thither, inserting their long bills into the tube-like flowers with absolute precision and lightning-like rapidity, but all the while engaged in a fierce combat with each other. They constantly maintained a position facing one another, and only 6 or 8 inches apart, suddenly rising a dozen feet into the air, where they would have a little battle, and as suddenly dropping like two bullets on one string back to the flowers, over and among which they would flit about like animated sun-beams.

Occasionally they would "hitch" and flutter all the way to the ground through the leaves and branches, where they would lie and pummel each other like two schoolboys, one on top and the other beneath, the top fellow pausing to take breath and then pummeling some more.

The under bird would appear to give up and look very dilapidated, with outstretched wings and disordered feathers, but the moment the top fellow let go and rose up to the top of the bush the bottom one would be there facing him again.

The most interesting feature of the performance was their utter obliviousness to my presence. As I stood near the palings watching them, which I did for a quarter of an hour, they would flutter around my head and about my face, occasionally striking me with their fluttering wings on face and hands, and one of them lighted for a moment on my thumb.

One now and again lighted on a picket within a foot of me and gave a quick side glance toward me, which was the only notice I appeared to excite from them. At last one of them retired, vanquished, and the other exultantly took possession of the flowers.

More graphically perhaps than by any other writer is this combative spirit of the Humming Bird described by Mr. H. W. Henshaw, in an interesting article on the birds of the Upper Pecos River, New Mexico, in "The Auk" for January, 1886 (pp. 76, 77), the species described being the Rufous-backed Hummer (*Selasphorus rufus*):

Males and females all flock to the common feeding ground, and as the Hummers, especially of the Rufous-backed species, are pugnacious and hot tempered in the extreme, the field becomes a constant battle ground whereon favorite flowers and favorite perching grounds are contested for with all the ardor that attaches to more important conquests. The fiery red throat of the Rufous-backed Hummer is an index of impetuous, aggressive disposition, and when brought into conflict with the other species it invariably asserts its supremacy and drives its rival in utter rout from the field. Nor do the males of this species confine their warfare to their own sex. Gallantry has no place apparently in their breasts, and when conquest has put them in possession of a perch near a clump of flowers they wage war on all comers, females as well as males.

Nor is the pugnacity of this Humming Bird limited to attacks on other species. The presence of a male of its own kind is sufficient to arouse it to the highest pitch of fury, and should the contestants be equally matched they will seize each other by the bill and, using their wings as offensive weapons, fall to the ground, roll over and over in fierce strife until exhausted, or until one is worsted, when he is off like a bullet for less dangerous hunting grounds followed by the exulting victor, who, however, soon gives over pursuit and returns to the perch he has so well won to preen his disordered plumage and make ready for a fresh contest.

When the attack is urged against the males of the Broad-tailed species the contest is less fierce, the latter species usually abandoning the ground in hot haste. The latter result always follows the assault of a male upon the females who, if less valiant in battle, are scarcely backward when it comes to the assertion of their rights against intruders of their own sex. The rivalry the females display is not less marked if the battles it prompts are less fierce than when the males are engaged;

occasionally the females will fight with all the ardor displayed by the males. The mimic contests thus hinted at rather than described—for the fury and spirit displayed in their battles must be seen to be appreciated—are continued all day long, and were the strength of the combatants at all proportionate to their fury the problem of Humming-Bird life would simply resolve itself down to a question of the survival of the strongest. But the tiny strength of these pigmies, though backed by never so much warlike spirit, is scarcely sufficient to detach a feather from each other's gleaming bodies, and even at the close of the season the male birds show little wear and tear and are in prime condition as regards their plumage.

If they have occasion to fear each other—and sometimes I have thought they fight merely for the pure fun of it—they fear nothing else. About our camp, where were a few clumps of the *Scrophularia*, they were especially fearless, and provided one remained reasonably quiet they would approach within 2 or 3 feet. When in such proximity their sharp eyes were constantly on the watch, and a hostile movement sent them away like streaks of flame. By gradual approach, however, I was able on several occasions to strike one down with my hat and secure it uninjured before it recovered either presence of mind or strength to get on wing.

On another occasion, Mr. Henshaw observed that "they manifested an especial animosity against the Broad-tailed Hummer (*Selasphorus platycereus*), and, on the appearance of one would instantly dart forth with shrill, angry notes, and attack and drive away the intruder, while the female, sitting on some neighboring tree, would watch the oft-repeated contest with evident interest and solicitude."

Dr. Edgar A. Mearns once saw a Ruby-throat (*Trochilus colubris*) attack a pair of Downy Woodpeckers upon the tree which it had chosen for its nest, and drive them off, while he also saw one dart furiously at a small red toy balloon which a boy was flying in a field.

That their contests with one another are not always of a sportive character, as suggested by Mr. Henshaw, is shown by Mr. Gosse's observations on the Jamaican species, which are recorded as follows:

The pugnacity of the Humming Bird has been often spoken of; two of one species can rarely suck flowers from the same bush without a rencontre. I once witnessed a combat between two, which was prosecuted with much pertinacity and protracted to an unusual length. In the garden were two trees of the kind called Malay Apple (*Eugenia malaccensis*), one of which was but a yard or two from my window. The genial influence of the spring rains had covered them with a profusion of beautiful blossoms, each consisting of a multitude of crimson stamens, with very minute petals, like bunches of crimson tassels; but the leaf buds were only beginning to open. A Humming Bird had every day and all day long been paying his devoirs to these charming blossoms. On the morning to which I allude, another came, and the maneuvers of these two tiny creatures became very interesting. They chased each other through the labyrinths of twigs and flowers, till, an opportunity occurring, the one would dart with seeming fury upon the other, and then, with a loud rustling of their wings, they would twirl together round and round, till they nearly came to the earth. It was some time before I could see, with any distinctness, what took place in these tussles; their twirlings were so rapid as to baffle all attempts at discrimination. At length an encounter took place pretty close to me, and I perceived that the beak of the one grasped the beak of the other, and thus fastened both whirled round and round in their perpendicular descent, the point of contact being the center of the gyrations, till, when another second would have brought them both on the ground, they separated, and the one chased the other for about 100 yards, and then returned in triumph to the tree, where, perched on a lofty twig, he chirped monotonously and pertinaciously for some time -I could not help thinking, in

> defiance. In a few minutes, however, the banished one returned and began chirping no less provokingly, which soon brought on another chase and another tussle. I am persuaded that these were hostile encounters, for one seemed evidently afraid of the other, fleeing when the other pursued, though his indomitable spirit would prompt the chirp of defiance; and when resting after a battle, I noticed that this one held his beak open as if panting. Sometimes they would suspend hostilities to suck a few blossoms; but mutual proximity was sure to bring them on again, with the same result. In their tortuous and rapid evolutions, the light from their ruby necks would occasionally flash in the sun with gem-like radiance, and as they now and then hovered motionless, the broadly-expanded tail, the outer feathers of which are crimson-purple, but when intercepting the sun's rays transmit orange-colored light, added much to their beauty. A little Banana Quit (*Certhiola flaveola*), that was peeping among the blossoms in his own quiet way, seemed now and then to look with surprise on the combatants; but when the one had driven his rival to a longer distance than usual, the victor set upon the unoffending Quit, who soon yielded the point, and retired humbly enough to a neighboring tree. The war (for it was a thorough campaign, a regular succession of battles) lasted fully an hour, and then I was called away from the post of observation.

While invincible against other birds of whatsoever kind, Humming Birds are, according to Mr. Gould, sometimes chased by the larger kinds of bumblebees, of which they seldom take the least notice, as their superiority of flight is sufficient to enable them to leave those slow-moving insects far behind in the short space of a minute.

### INTELLIGENCE.

Mr. Gould refers to the high order of intelligence "so nearly approaching to that of reason" possessed by Humming Birds, and others add their testimony to that presented by him. This great intelligence is most obvious in connection with their nesting, when some kinds, in certain exigencies, seem really to possess a distinct knowledge of the laws of equilibrium and gravitation, as the following will show:

> Some of the Humming Birds [says Mr. Gould] are said to suspend their great nests by the middle from the fine hanging roots of a tree, or a tendril; and should the nest, which is of a curved form and built of any coarse materials at hand, prove to be heavier on one side than the other, the higher side is weighted with a small stone or square piece of earth until an equilibrium is established and the eggs prevented from rolling out. If such powers, so nearly approaching to that of reason, should be doubted by some of my readers, I can assure them one or more of these loaded nests are contained in the Loddigesian Collection, and one is at this moment before me, an examination of which will satisfy the most skeptical of the truth of this statement. Occasionally the old nests are repaired or [new ones are] built over the old one, two, three, or more years in succession.

The Humming Birds which thus display so much intelligence belong to the genus *Oreotrochilus*, the species of which inhabit the higher regions of the Andes immediately below the line of perpetual snow. One of them, the Pichincha Humming Bird (*Oreotrochilus pichincha*), builds a nest similar to that described above, but usually secures the equilibrium of the nest by simply adding to the ordinary materials on one side, thus by increasing the bulk on that side also adding to the weight.*

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*A nest of this species is shown on plate VI, Fig. 2.

A nest of *Doricha enicura* found by Mr. Salvin in Guatemala further illustrates the remarkable reasoning faculties of Humming Birds. It "was most curiously placed in the cup-shaped top of a fruit of the Nopal (*Cactus cochinellifera*), the fastenings being dexterously wound round the clustering prickles and thus retaining the whole structure firmly in its place." It was remarkably shallow, so much so, in fact, that had it not contained two eggs Mr. Salvin "would have pronounced it far from complete;" and he adds that "it may be that, being based on a firm foundation (one not nearly so liable to oscillation by the wind), the bird had found that a greater depth was not necessary to keep the eggs from falling out. Had she placed her nest on a slender twig, as usual, the case might have been different." (The Ibis, vol. II, p. 264.)

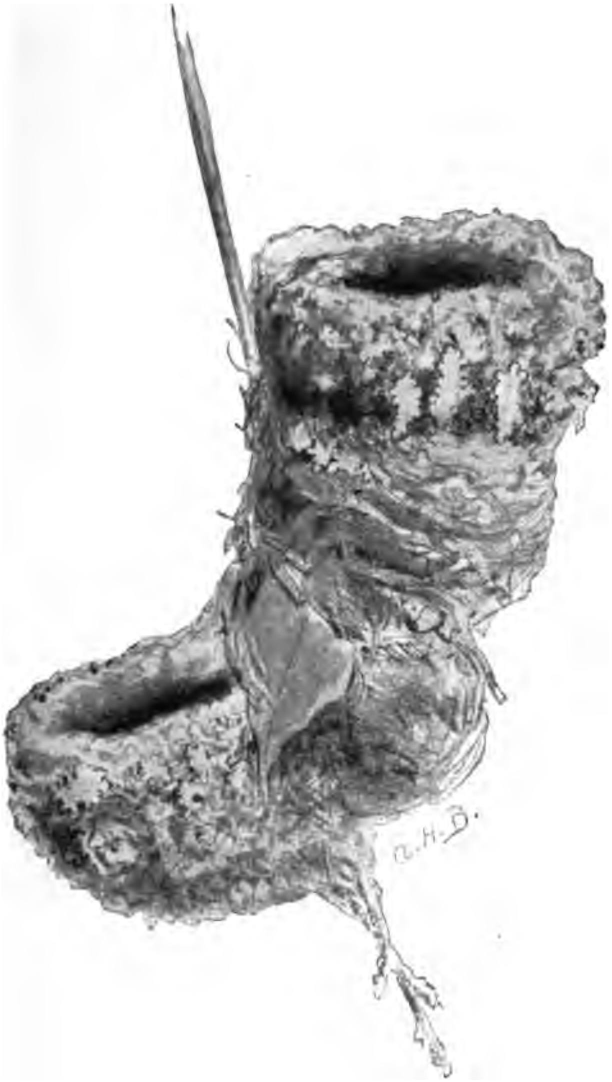
An extraordinary and most convincing exhibition of a Humming Bird's intelligence once came under the personal observation of the writer. A nest of the Broad-tailed Humming Bird (*Selasphorus platycercus*) had been built upon a dead twig of an aspen bush, some 3 feet from the ground; the dry atmosphere had caused the bark of the twig to crack, making a transverse fissure on each side of the nest, the wood at the same time shrinking so that the cylinder-like section of bark inclosed it loosely. After the eggs were laid something had caused the section of bark to turn, so that the nest hung inverted on the under side of the branch, of course spilling out the eggs. When found by the writer the nest was in this position, with the fragments of the eggs lying on the ground beneath it; but immediately above the original nest was a new one, very much smaller than the first, containing two fresh eggs. Evidently the owners knew that by building a much smaller nest above the old one (which was rather a bulky one for the species) the greater weight of the latter would keep the former in position and thus prevent a recurrence of the accident.

Mr. C. H. Holden was "struck with the *wisdom*" of this same species in the matter of nest-building, a nest which he found in the Black Hills of Wyoming having been built upon one of the lower branches of a tree that had fallen across a brook, in such a way that the trunk of the tree effectually shielded it from the rain and sun.

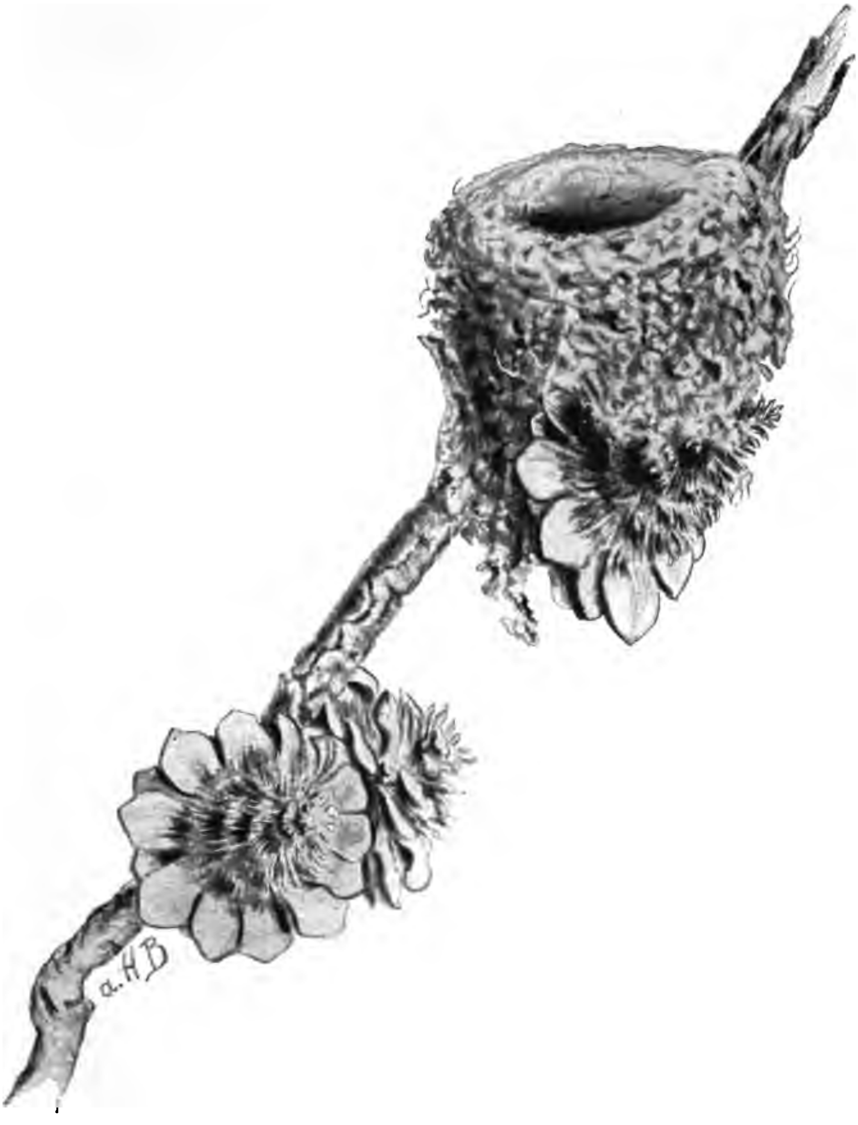
Other Humming Birds, again, build their nests of materials corresponding exactly in color with the branches to which they are attached, this being frequently the case with the Calliope Humming Bird (*Stellula calliope*) of the western United States, which often builds its nest upon a dead pine branch, upon or near a cone of similar size and color, as shown on plates II and III, while some of the tropical species, of the genus *Phaëthornis*, attach theirs to the tip of a long pendant leaf of a palm, as shown on plates IV and V.

## NESTS AND EGGS.

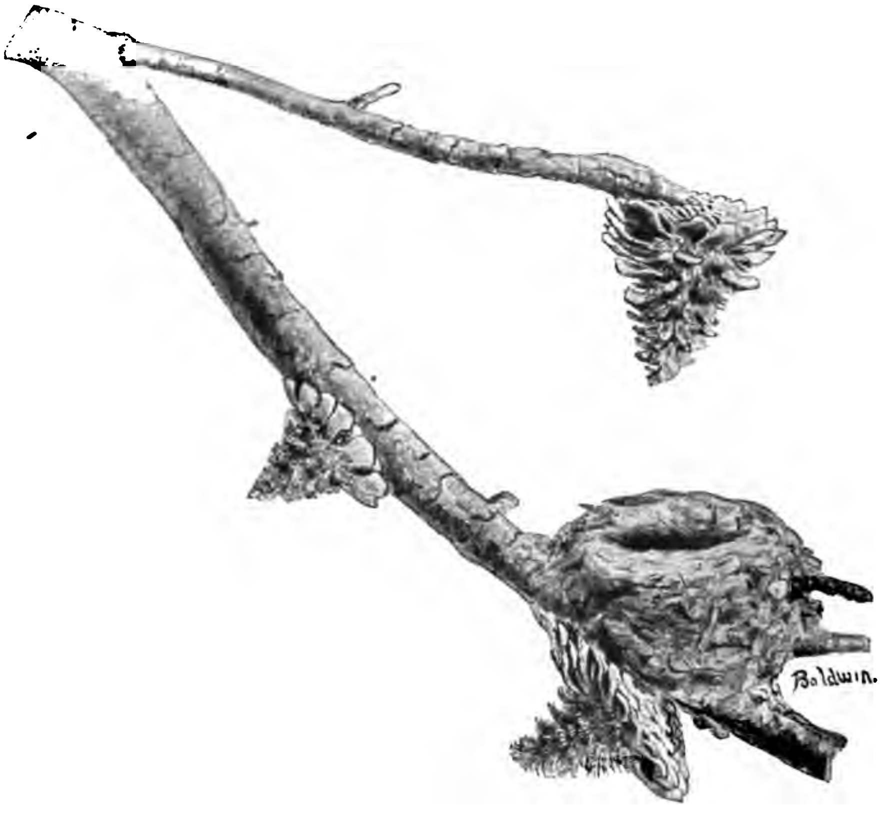
Humming Birds' nests are among the most beautiful examples of bird architecture. They are usually compactly felted structures, of various forms, the cup-shaped or turban-shaped, however, prevailing, the ma-



**Four nests of Calliope Humming Bird** (*Stellula calliope*) on one branch, probably built during successive seasons. (Cat. No. 18915, U. S. N. M. Baird, California. Collected by Charles H. Townsend.)



**Nest of Calliope Humming Bird** (*Stellula calliope*) on dead pine branch with cones. (Cat. No. 21758, U. S. N. M. Fort Klamath, Oregon. Collected and presented by Capt. Charles E. Bendire, U. S. A.)



**Nest of Calliope Humming Bird** (*Stellula calliope*) on dead branch of pine, canopied by and mimicing cone. (Cat. No. 21759, U. S. N. M. Fort Klamath, Oregon. Collected and presented by Captain Charles E. Bendire, U. S. A.)

terials of which they are composed consisting chiefly of plant down, interwoven and strengthened by spiders' webs, and often ornamented by an external mosaic of small lichens, small soft feathers being more rarely employed. Their method of attachment to their support varies greatly according to the species. Ordinarily the nest is saddled upon a horizontal or slanting twig, to which it is very firmly bound by the spiders' webs of which it is largely composed. The Hermit Humming Birds (genus *Phaëthornis*), however, fasten their elongated nests to one side of the extremity of long pointed leaves, for protection, it is supposed, against monkeys and other predaceous animals. Others, according to Mr. Gould, are hammock-shaped, and are most ingeniously attached to the face of cliffs or rocks by means of spiders' webs. Those made by the "Hill-stars" (genus *Oreotrochilus*), of the snowy regions of the Andes, are described by Mr. Gould as being "very large, and composed of wool, llama hair, moss, and feathers; at the top of this great mass, of nearly the size of a man's head, is a little cup-shaped depression in which the eggs are deposited." A nest of the Pichincha Hill-star (*O. pichincha*) was found by Professor Jameson at a farm-house on the snowy mountain of Antisana, in Ecuador, at an altitude of 13,500 feet. It was attached to a straw rope suspended from the roof, in one of the lower apartments to the house, the entrance to which was unprovided with a door. (See pl. VI, fig. 2.) In the series of illustrations comprising plates II–XIV we have selected examples of the extreme variations of form and other characters in Humming Bird nest architecture, and to these the reader is referred for further information.

The high degree of intelligence displayed by Humming Birds in concealing their nests by making them of such form or material as will serve to imitate natural excrescences of a branch, such as a knot or a pine cone, and in repairing accidents, has been referred to on the preceding page. Sometimes the location of a nest pleases the owners so well that they are unwilling to abandon the site, a new nest being added to the one of the preceding year for several consecutive seasons. A beautiful example of this is shown on plate I. The specimen from which the illustration is taken is a nest of the Calliope Humming Bird (*Stellula calliope*) in the National Museum collection, collected by Mr. Charles H. Townsend on the St. Cloud River, northern California, June 9, 1883, and shows distinctly *four* nests thus united. The writer once found a double nest of the Broad-tailed Humming Bird (*Selasphorus platycercus*), the older one having, by the loosening and cracking of the bark to which it was fastened, fallen around on the under side of the twig, the new one being built immediately above it (see page 282). A double nest of the Ruby-throat (*Trochilus colubris*) is described by Mr. Edwin H. Eames in "The Hub" for July, 1890 (pp. 286, 287), as follows:

> On June 5, 1888, I secured a nest, containing one young bird and an egg on the point of hatching, of the Ruby-throated Humming Bird. The nest is a very peculiar one, being constructed upon one of the preceding year, and in a very conspicuous sit-

nation upon a branch of a sycamore, which inclined at an angle of 45 degrees. It was about 12 feet from the ground, on the lowest branch (a dead one), with no foliage whatever to afford concealment, and could be readily seen from a distance of 60 to 75 feet in any direction.

The old nest is much the worse for wear, having passed through at least one winter; the new one was built partly on one edge of this and partly on the adjoining branch, leaving fully one-half of the distorted cavity at the base exposed. The entire external surface of both is covered in the usual way with lichens, although not in any way resembling the smooth, mottled surfaces adjoining. It would seem that the scenes of bygone associations have some permanent attractions, even though comparatively barren to our eyes.

While, as a rule, but little attempt is made at concealment by hiding it behind foliage in the usual manner of most birds, so much does the nest of the average Humming Bird resemble some natural excrescence or bit of rubbish that it might easily pass undetected. In fact, most Humming Birds' nests which are discovered are found by accident or by carefully watching the movements of the birds when they are suspected to have a nest in the vicinity; and all that the writer has found, with perhaps two or three exceptions, were discovered by accidentally brushing against the bush or branch on which it was located, causing the parent to hastily fly out and thus betraying its proximity.

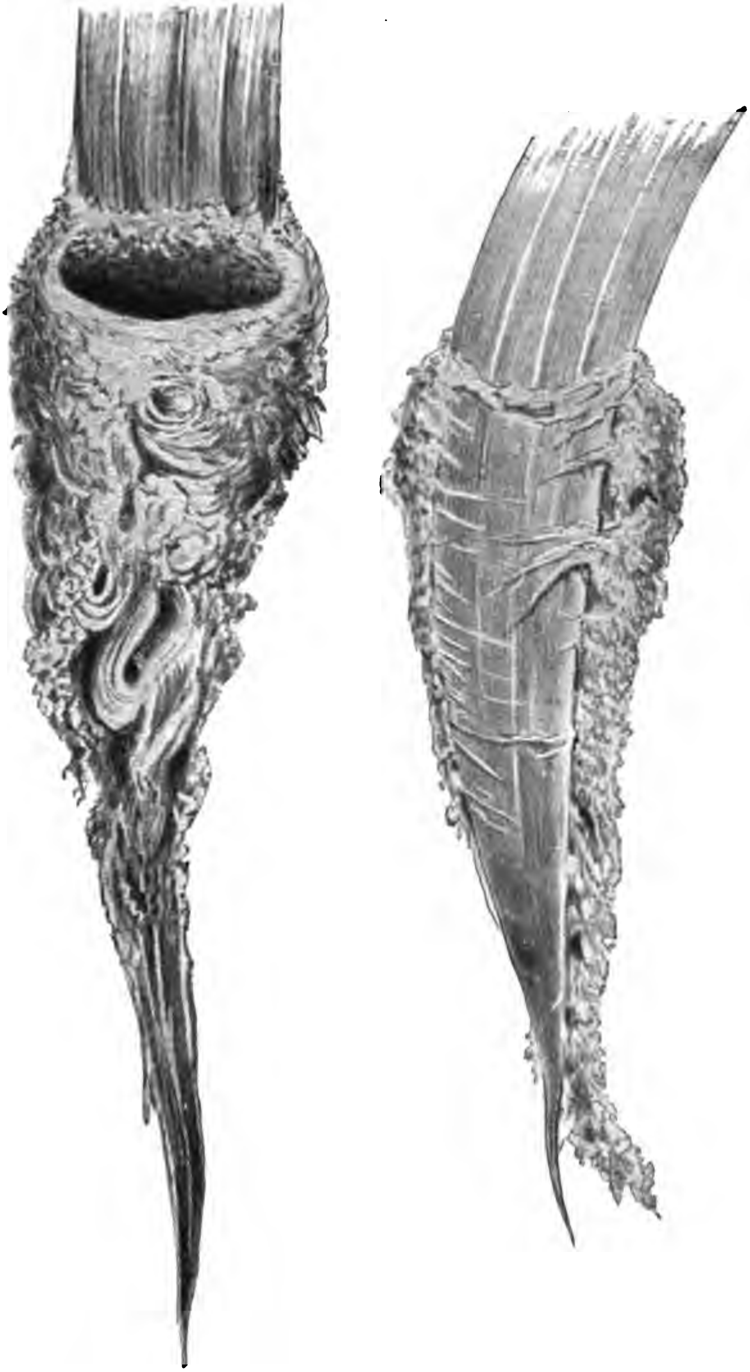
The eggs of Humming Birds are universally only two in number and immaculate white in color, though, according to Mr. Gould, there is "one supposed exception, namely, that of a species inhabiting the upper Amazon, which, according to Mr. Edwards, lays a spotted egg." But there can be little doubt that this supposed exception does not in reality exist, the egg of some small Passerine bird having been wrongly identified as that of a Humming Bird.

The eggs of Humming Birds are large in comparison to the bird which lays them; in form they are usually oblong, or nearly alike at both ends, though sometimes one end is a little smaller than the other; the color, even when freshly laid, is a nearly dead pure white, the comparative thickness of the shell preventing that pinkish glow so frequently seen in eggs of small Passerine birds.

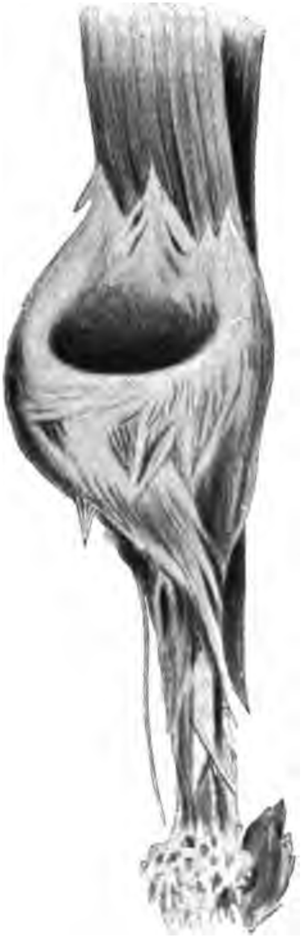
According to Mr. Gould two broods are produced in a season, the period of incubation occupying 12 to 14, or according to Captain Lyon, 18 days.

### VOICE.

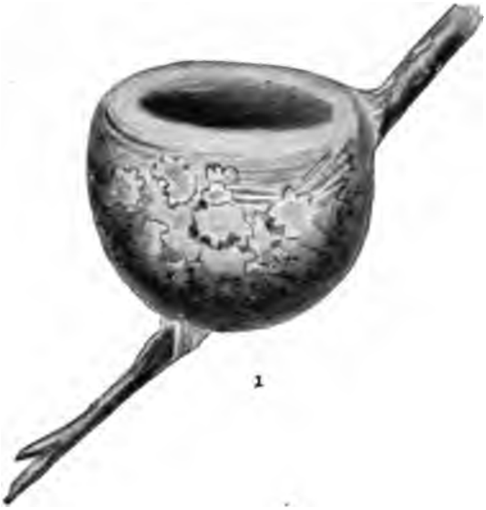
The voice of Humming Birds, as a rule, is of a twittering character, not conspicuous for loudness or any other quality, and may be compared with the vocal utterances of the Swifts better perhaps than those of any other group of birds. The notes are of course varied to a degree, according to the mood of the bird which utters them, anger, pleasure, and alarm each calling forth its peculiar expression. Some species are said to possess a song, but it is doubtful if any approach more nearly to a song than a sort of warbling twitter, which the males of many kinds produce during the pairing season. Mr. Gosse says that the Vervain



Nests of Gray-throated Hermit (*Phaëthornis griseigularis*). (After Gould.)



NEST OF PYGMY HERMIT (*Phaëthornis pygmæus*). (After Gould.)



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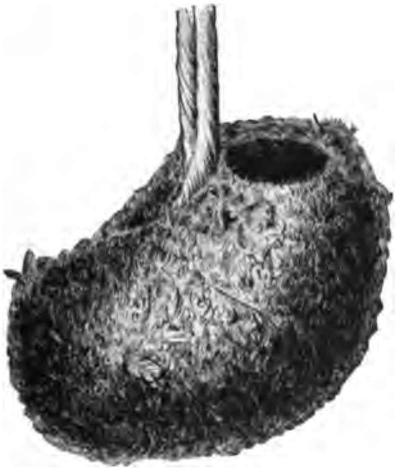
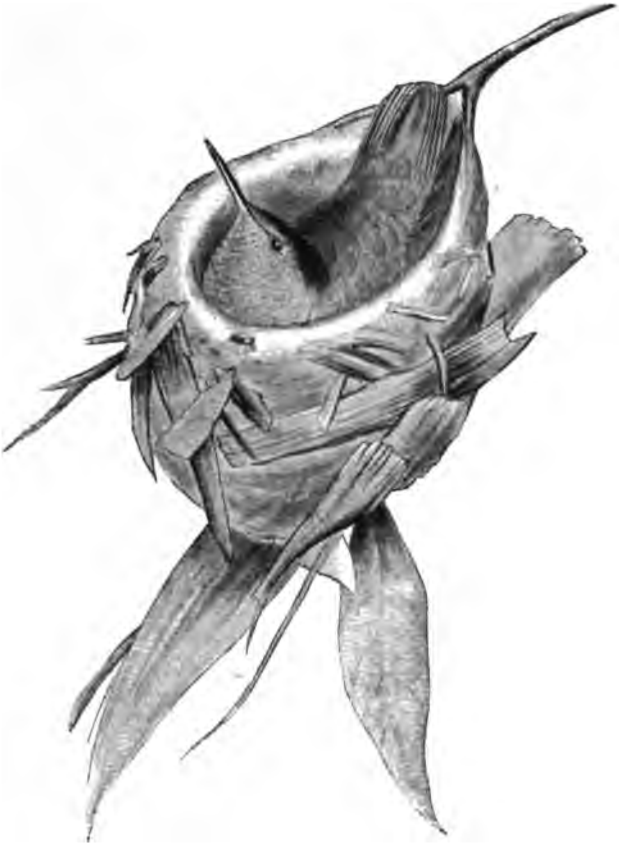


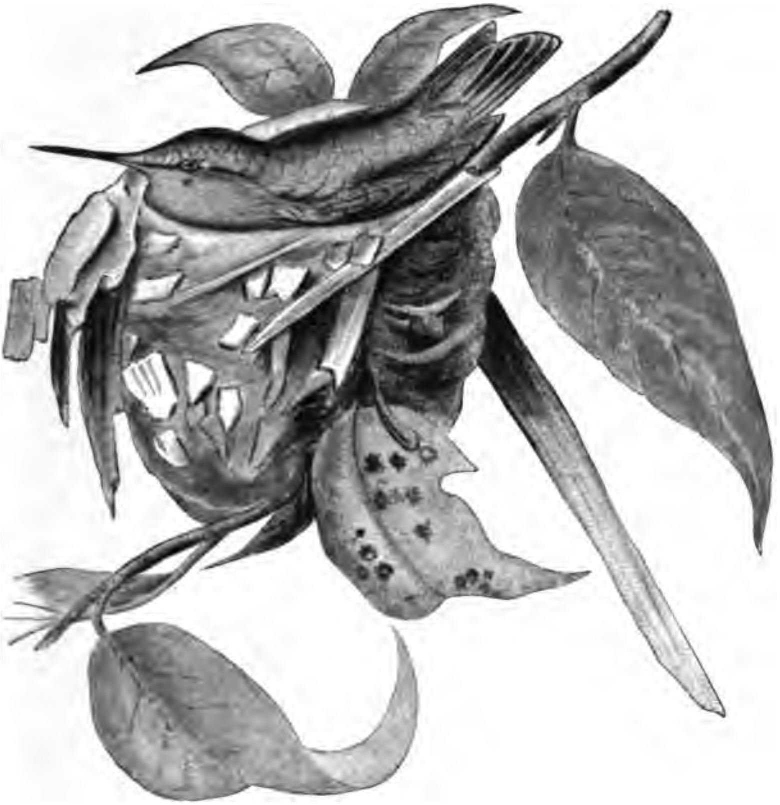
2

Fig. 1. Nest of Frilled Coquette (*Lophornis magnificus*). (After Gould.)

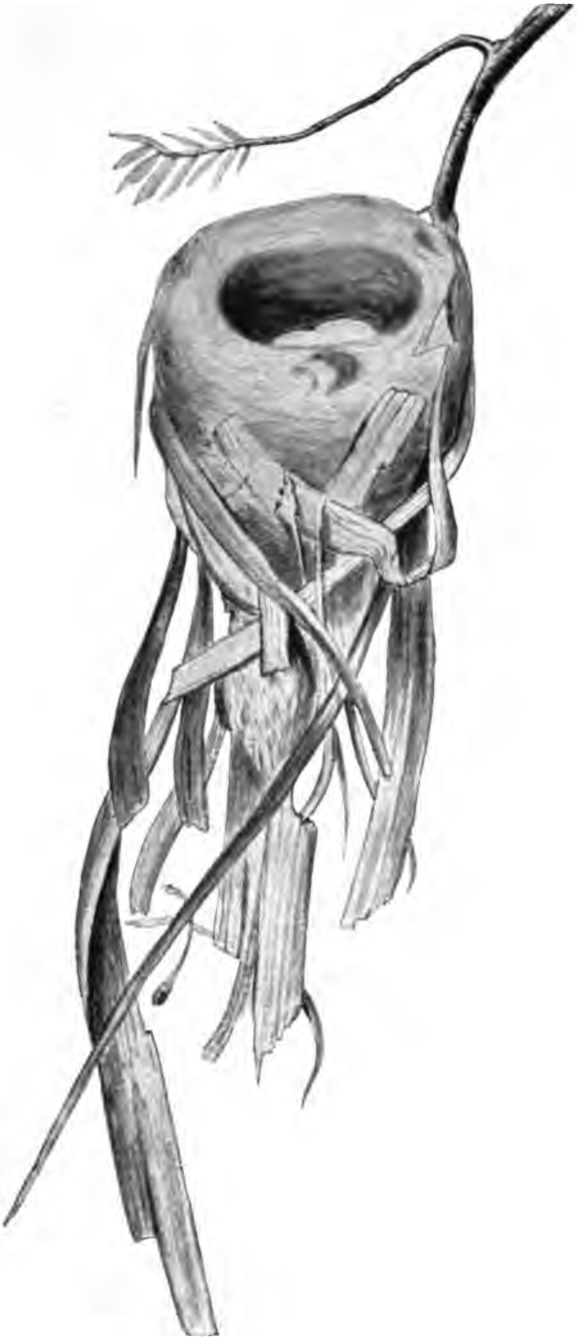
Fig. 2. Nest of Pichinchian Hill-star (*Oreotrochilus pichincha*). (From Proc. Zool. Soc. London, 1860, p. 80. Half natural size.)



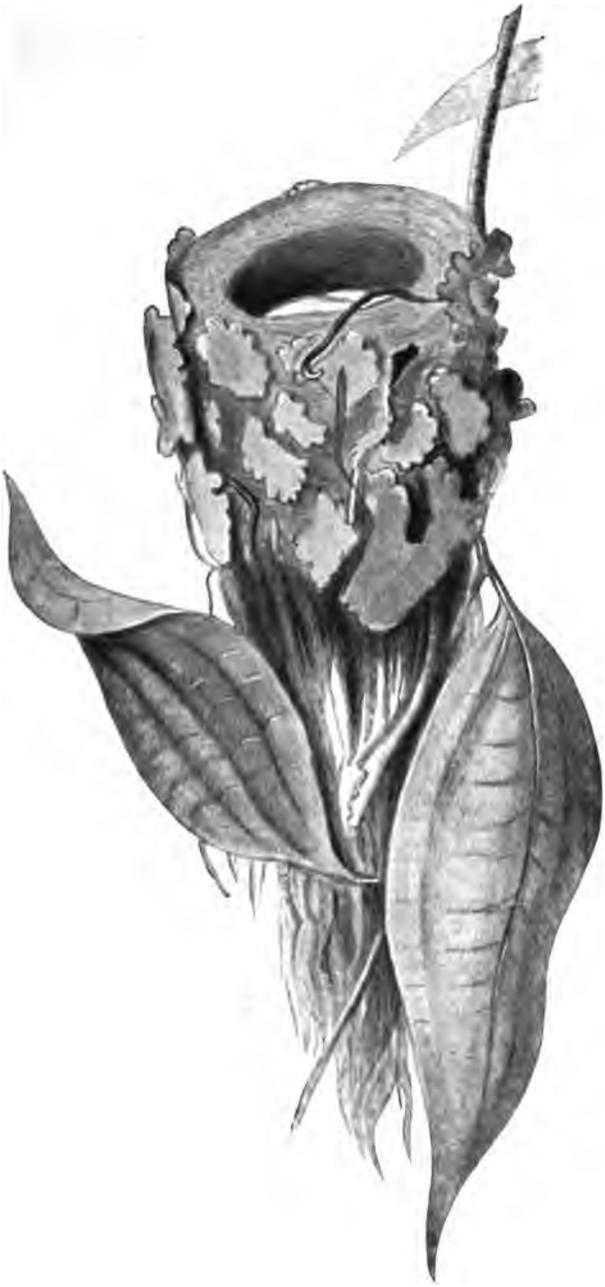
NEST OF ALLIED EMERALD (*Agyrtria affinis*). (After Gould.)



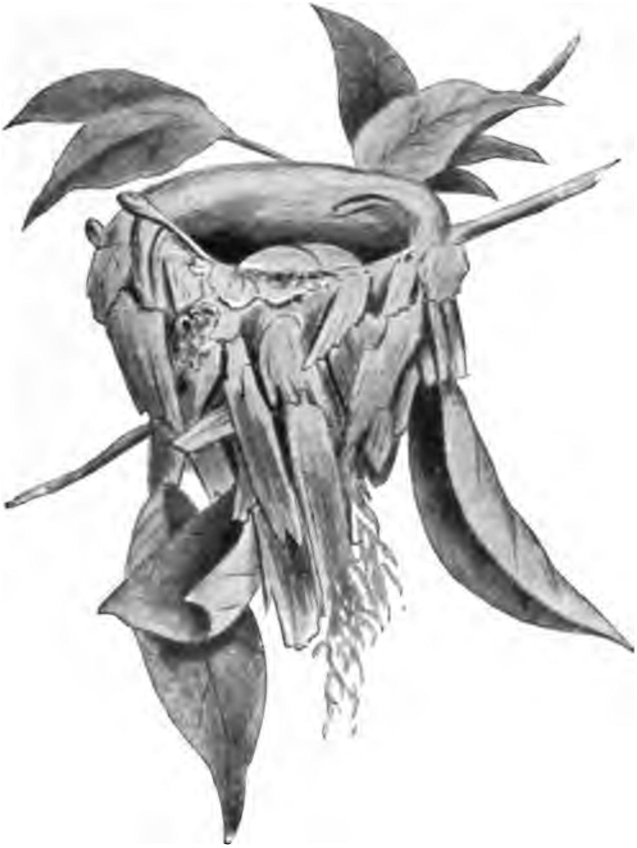
**Nest of Brazilian Emerald** (*Chlorostilbon prasinus*). (After Gould.)



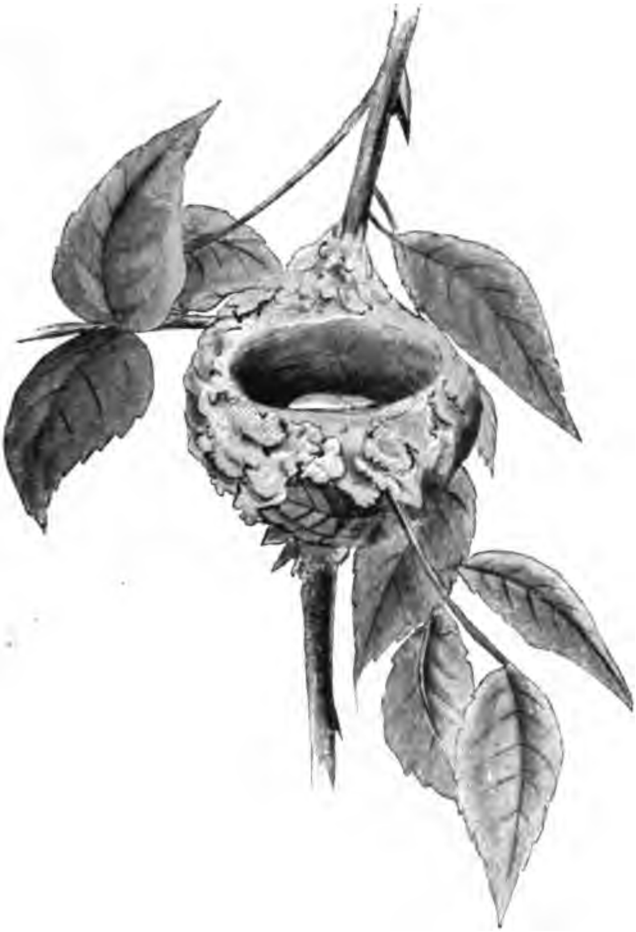
NEST OF RED-THROATED SAPPHIRE (*Hylocharis sapphirina*). (After Gould.)



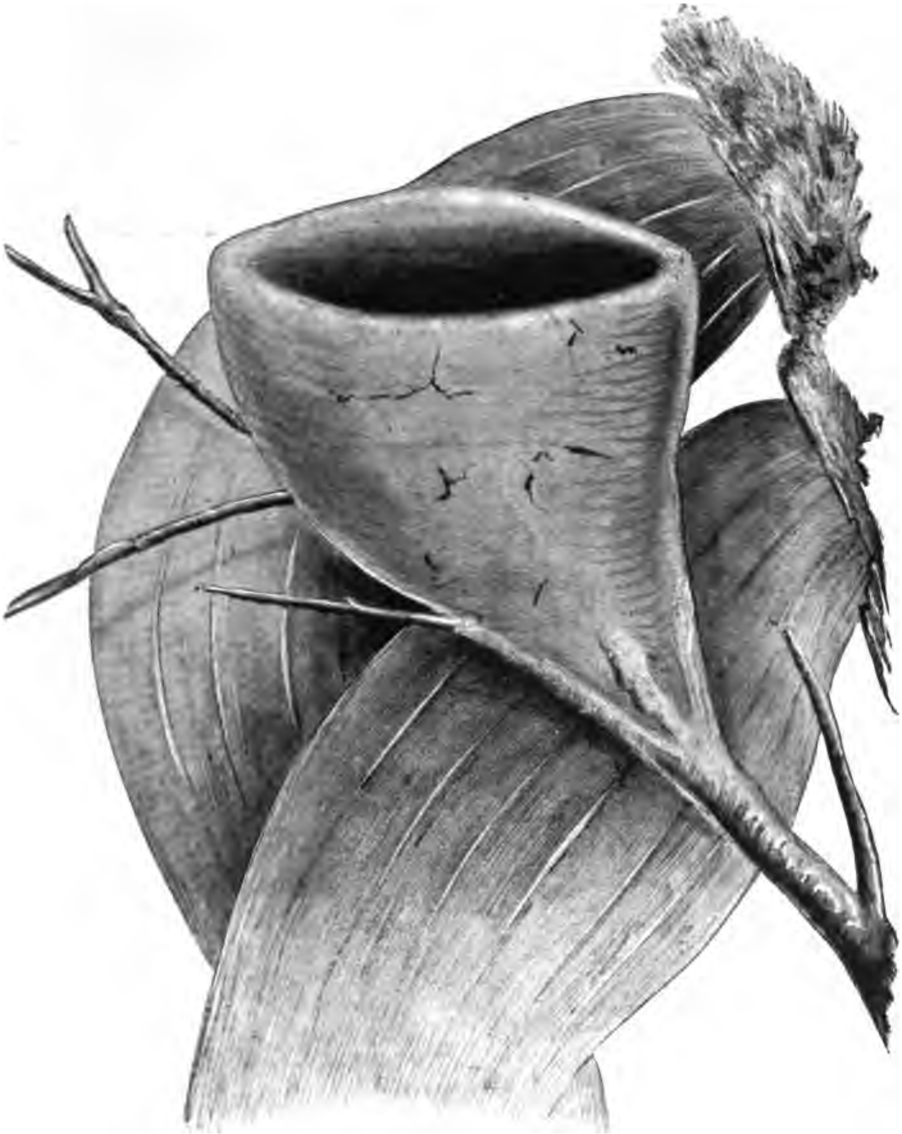
NEST OF BRAZILIAN WOOD NYMPH (*Thalurania glaucopis*). (After Gould.)



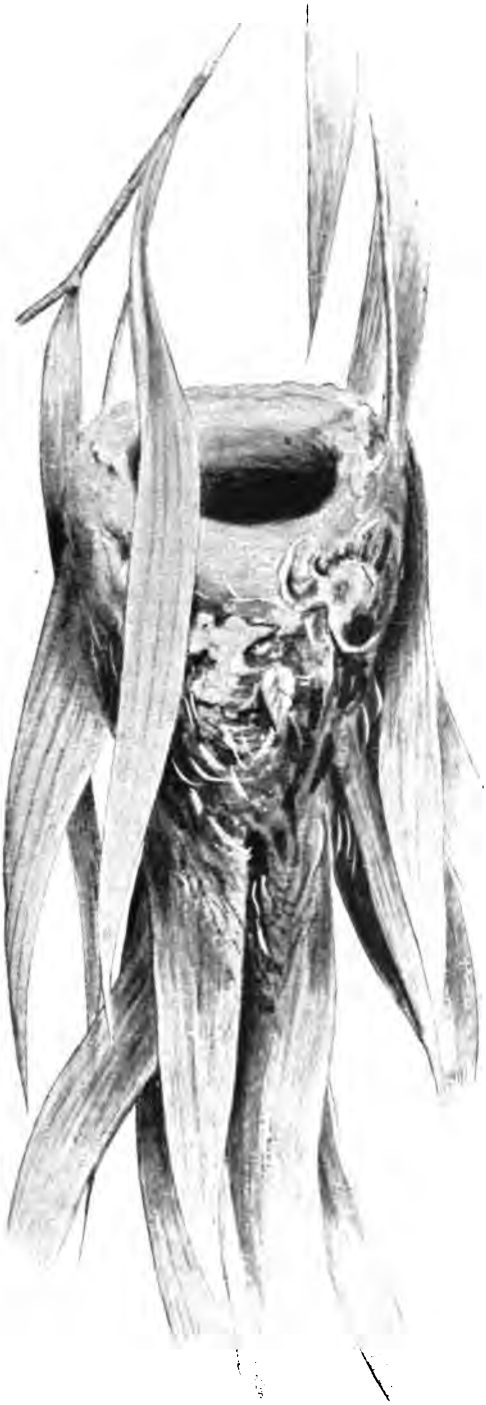
**NEST OF SHORT-BILLED EMERALD** (*Agyrtria brevirostris*). (After Gould.)



NEST OF THE SPARKLING-TAIL (*Tilmatura duponti*). (After Gould.)



NEST OF FIERY TOPAZ (*Topaza pyra*). (After Gould.)



NEST OF DE LALAND'S PLOVER-CREST (*Cephallepis delalandi*). (After Gould.)

Humming Bird (*Mellisuga minima*) of Jamaica is the only one known to him which has a real song. Soon after sunrise, says he, in the spring months, it is fond of sitting on the topmost branch of a mango or orange tree, where it warbles in a very weak but very sweet tone a continuous melody for 10 minutes at a time, but the so-called song has little variety. A Mexican Humming Bird (the Wedge-tailed Sabre-wing, *Sphenoproctus curvipennis*), according to Mr. R. Montes d'Oca, is called by the people of Coantepec, near Jalapa, *Chupamirto fandanguero*, which means "Fandango Myrtle-sucker," on account of its somewhat musical voice. It is the only Humming Bird of his acquaintance whose notes are sufficiently distinctive to recognize it by in the woods, and though monotonous they are very pleasing.

Speaking of the notes of several of the Humming Birds of Arizona, Mr. F. Stephens * says that of *Calypte costæ*, the female, while feeding, keeps up a pretty constant vocal noise which somewhat resembles the buzz of the wings, and that the feeding note of the male is finer and not so frequent. Of *Trochilus alexandri* he says that its notes, both of the male and the female, are similar to those of *C. costæ*.

> I have heard the song of each [says he], but it was some time since, and, as I remember it, there was little difference between the two species. I think that the males are the only ones who sing. The song is sweet and very low, but if it is perfectly quiet around it can be distinctly heard for a distance of 10 yards. As might be expected from the size of the bird, it is on a very high key, something like the sound produced by whistling between the teeth, very low yet at a high pitch. It might be called a warble, and I have heard it kept up for several minutes at a time. At such times I have never been able to find a female in the vicinity, and have come to the conclusion that it was sung for the individual's own amusement.
>
> There is still another Hummer note—that of the chase. They are very fond of chasing one another, sometimes for sport, often for spite. This note also resembles the feeding note, but is louder and possesses a chippering character, sometimes almost like the sound produced by lightly and rapidly smacking the lips together. I can detect but little difference between the sexes and it appears much the same whether the chase is in sport or in anger. Furthermore, it is often made by the pursued as well as the pursuer. At such times I am always reminded of a lot of schoolboys playing tag.
>
> If a Hummer is perched and a person passes near they start off, uttering a note similar to that made while feeding, but, should it be a female which you have frightened from her nest, she will go off silently.

## FOOD.

In feeding from flower to flower Humming Birds, besides obtaining nourishment for themselves, perform in the economy of nature the same office as insects, by transferring pollen from one bloom to another, and thus assisting in their fertilization.

Humming Birds that peer like bees
In stamen and in pistil.—MACKAY.

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* Bulletin of the Ridgway Ornithological Club of Chicago, No. 2, April, 1887, pp. 42-45.

It is popularly supposed that Humming Birds feed entirely on nectar obtained from flowers, but it has long been known that insects form a portion of their food. This fact was established as long ago as 1804, by Dr. B. S. Barton, in an article in Barton's Medical and Physical Journal, part 1, vol. I, pp. 88, 89. The evidence is somewhat conflicting as to whether insects or honey preponderate in the Humming Bird's bill of fare, but very probably the relative proportions of the two kinds of food vary under different circumstances. One observer (Mr. Manly Hardy, in The Auk, July, 1887, p. 255) asserts that they "sometimes feed the young on insects within 24 hours from the time they are hatched."

A young bird, about 2 days old, of the Ruby-throat (*Trochilus colubris*), taken by Mr. Edwin H. Eames, of Bridgeport, Connecticut, appears to have been fed exclusively on young spiders. He says:

> Its throat being much distended, I sought the cause by lightly pressing with a dull instrument from the thorax toward the bill, and succeeded in bringing to light 16 young spiders of uniform size. These measured about 0.11 of an inch in length, and with outspread legs covered a circle of 0.26 of an inch in diameter. Dissection revealed a pultaceous mass of the same in the stomach, but no more liquid than would result during digestion of insects of this gelatinous character. They were all of the same species, and may have been young found about certain plants in the immediate vicinity. It is surprising that young Humming Birds of this age could thrive, as it would seem, entirely upon insects, although the quality be of the finest. (The Auk, July, 1890, p. 287.)

Mr. A. R. Wallace even goes so far as to state his belief that insects form the principal food of Humming Birds. He says: *

> The great number of species that frequent flowers, do so, I am convinced, for the small insects found there, and not for the nectar. In dozens, and perhaps hundreds, of common flower-frequenting species which I have examined, the crop, stomach, and intestines have been entirely filled with minute beetles, bees, ants, and spiders, which abound in most flowers in South America. Very rarely, indeed, have I found a trace of honey or of any liquid in the crop or stomach. The flowers they most frequent are the various species of *Inga*, and the papilionaceous flowers of many large forest trees. I have never seen them at the Bignonias or any flowers but those which grow in large masses, covering a whole tree or shrub, as they visit perhaps a hundred flowers in a minute, and never stop at a single one. The little Emerald Hummer I have seen in gardens and at the common orange *Asclepias*, which often covers large spaces of waste ground in the tropics. But there are many, such as *Phaëthornis eremita*, and some larger allied species, which I have never seen at flowers. These inhabit the gloomy forest shades, where they dart about among the foliage, and I have distinctly observed them visit, in rapid succession, every leaf on a branch, balancing themselves vertically in the air, passing their beak closely over the under surface of each leaf, and thus capturing, no doubt, any small insects that may be upon them. While doing this the two long feathers of their tail have a vibrating motion, serving apparently as a rudder to assist them in performing the delicate operation. I have seen others searching up and down stems and dead sticks in the same manner, every now and then picking off something, exactly as a Bush-Shrike or a Tree-creeper does, with the exception, that the Humming Bird is constantly on the wing. They also capture insects in the true Fissirostral manner. How often may they be seen perched on the dead twig of a lofty tree, the same station that is chosen by the Tyrant Flycatchers and the Jacamars, and from which, like those birds, they

> dart off a short distance and, after a few whirls and balancings, return to the identical twig they have left. In the evening, too, just, after sunset, when the Goatsuckers are beginning their search after insects over the rivers, I have seen Humming Birds come out of the forest and remain a long time on the wing, now stationary, now darting about with the greatest rapidity, imitating in a limited space the varied evolutions of their companions the Goat-suckers, and evidently for the same end and purpose.
>
> Many naturalists have noticed this habit of feeding on insects, but have generally considered it as the exception, whereas, I am inclined to think it is the rule. The frequenting of flowers seems to me to be only one of the many ways by which they are enabled to procure their insect food.

Mr. Wallace is probably correct in his belief that insects constitute their principal food so far as the Hermit Humming Birds (*Phaëthornis* and allied genera) are concerned, for these birds are quite different in many respects from the typical Humming Birds; but there can not be the slightest question that, as a rule, the typical hummers feed to a very large extent at least, on the honey or the nectar of flowers. His observation respecting their alleged avoidance of flowers of the *Bignoniaceæ* is also unimportant, since the common Ruby-throat (*Trochilus colubris*) of eastern North America may often be seen extracting its food from the large trumpet-shaped, brilliant orange-red flowers of the native Trumpet Creeper (*Tecoma radicans*), a typical member of that order of plants.

In fact, evidence is abundant and conclusive that Humming Birds will often reject insects when honey is accessible, or even an artificial sirup made of sugar and water is presented to them. Mr. W. H. Ballou has recorded, in the "American Naturalist," the result of some experiments, suggested by Mr. Wallace's statements, which he made, as follows:

> Two Hummers were attracted to the house by a saucer of sirup placed on a window sill. Each day they would come and satisfy their hunger. In each instance they would alight on the edge of the saucer, and lap up the sirup as a dog would lap water. The question as to whether insects " pass down the tubes or are entangled in the fibrous tips, and are thus drawn back into the gullet," was also solved. Insects too large to pass through these tubes being placed in their way, the birds were observed to take them as readily as the smaller ones. The insects were evidently secured by adhesion to the saliva of the tongue-tips, and thence drawn into the gullet.

The following, communicated to "The Auk," for April, 1885 (pp. 218, 219), by Mr. S. W. Willard, is also quite to the point:

> Somewhere it has been stated, that the Humming Bird derives the most of its nourishment from the minute insects which adhere to the nectar of flowers, and which are imbibed with the honey. Undoubtedly many insects are thus secured and furnish their share of nutriment to the species, but in the following account of a Hummer in confinement, kindly furnished to me by Miss Hattie Brubaker, it will be seen that insects are not wholly essential to the maintenance of life, in *Trochilus colubris* at least.
>
> The bird, she writes, was taken September 1, near De Pere, Wisconsin, and throve nicely until October 28, when it met an untimely death. After it had struggled in vain for nearly 2 days to escape from a room into which it had accidentally flown, it was picked up in an exhausted condition and carefully placed out of doors in an arbor, in hopes of its recovering sufficiently to fly away. A severe cold rain that night

completely numbed it, so that it was again taken to the house a mere bunch of rumpled feathers—no life then being apparent. A slight warming quite unexpectedly revived it, and it was but a short time before it opened its eyes and flew to a nail, and then immediately began to rearrange its plumage. As flowers and sweetened water were offered to this captive before it was taken to the arbor, without its once noticing them, Miss Brubaker was rather at a loss to know how to feed it; but at last she conceived of placing some sugar and water in a conspicuous gladiolus blossom, which the Humming Bird soon discovered and visited, drinking greedily the honey that was in the blossom. After this it became quite lively, flying from its nail to some dried flowers and grasses in another room, where it had rested during the two days it had remained in the house without food or water.

With the aid of a petunia blossom as a decoy, this little bird was soon taught to drink from a small phial, holding about two teaspoonfuls of sugar and water (about one-third sugar), that was suspended by a string to the window casing. It was but a day or so before it seemed perfectly contented, not showing the least fear, but seemingly growing stronger as well as larger in its new home.

Miss Brubaker thinks the bird was not an old one, as its tail feathers grew considerably after she had it. She says that at first they kept a variety of cut flowers in the room with it, but it barely alighted upon them, flying at once to the bottle which it had learned to appreciate. Somewhat after the manner of obtaining nectar from a flower, it would sip a moment at the bottle and then dart away; but it was not long in finding that the supply of sweetened water was inexhaustible, and that there was no necessity of hastening its meal. At times it would drink so much that its wings were unable to sustain the weight of the body, and a fall to the floor was the result of its excessive fondness for this artificial nectar. When left to itself and no check put upon its drinking, it would consume at least half the contents of the phial daily—at least one-half as much as its own bulk.

"We are certain," she writes, "that for at least a month the bird had access to no flowers whatever, thus making it certain that the sweetened water furnished it its sole nourishment, and during this captivity it did not show the first signs of diminishing strength."

At the approach of cold weather it was placed in a cage, in which its little history was brought to a close by its accidentally entangling one of its claws in a loose wire which secured a small perch into the cage, and thus suspended with its head downward it was found by Miss Brubaker the next morning—another "bunch" of rumpled feathers.

The following very interesting description of the manner of feeding of the Long-tailed Humming Bird (*Aithurus polytmus*) is to be found in that delightful little book, Gosse's Birds of Jamaica:

> Perceiving that he [the captive] had exhausted the flowers, I prepared a tube, made of the barrel of a goose-quill, which I inserted into the cork of a bottle to secure its steadiness and upright position, and filled with juice of sugar-cane. I then took a large *Ipomœa*, and, having cut off the bottom, I slipped the flower over the tube, so that the quill took the place of the nectary of the flower. The bird flew to it in a moment, clung to the bottle rim, and bringing his beak perpendicular, thrust it into the tube. It was at once evident that the repast was agreeable, for he continued pumping for several seconds, and, on his flying off, I found the quill emptied. As he had torn off the flower in his eagerness for more and even followed the fragments of the corolla as they lay on the table to search them, I refilled the quill and put a blossom of the Marvel of Peru into it, so that the flower expanded over the top. The little toper found it again, and, after drinking freely, withdrew his beak, but the blossom was adhering to it as a sheath. This incumbrance he presently got rid of, and then (which was most interesting to me) he returned immediately and, inserting his beak into the bare quill, finished the contents. It was

amusing to see the odd position of his head and body as he clung to the bottle with his beak inserted perpendicularly into the cork. Several times in the course of the evening he had recourse to his new fountain, which was as often replenished for him, and at length, about sunset, betook himself to a line stretched across the room for repose.

In view of the somewhat conflicting evidence as to whether insects or nectar constitute their principal food, it may be well to examine the structure of the tongue of Humming Birds, and by doing so determine, if possible, which side of the controversy is most favored thereby. No one has described the tongue of a Humming Bird so tersely as Mr. Gosse, whose description of the tongue of *Aithurus polytmus*, herewith given, was taken from freshly killed specimens:

> The tongue of this species (and doubtless others have a similar conformation) presents, when recent, the appearance of two tubes laid side by side, united for half their length, but separate for the remainder. Their substance is transparent in the same degree as a good quill, which they much resemble. Each tube is formed by a lamina rolled up, yet not so as to bring the edges into actual contact, for there is a longitudinal fissure on the outer side, running up considerably higher than the junction of the tubes; into this fissure the point of a pin may be inserted and moved up and down the length. Near the top the *outer* edge of each lamina ceases to be convoluted, but is spread out, and split at the margin into irregular fimbriæ which point backward, somewhat like the vane of a feather. These are not barbs, however, but simply soft and flexible points, such as might be produced by snipping diagonally the edge of a strip of paper. I conjecture that the nectar of flowers is pumped up the tubes, and that minute insects are caught, when in flowers, in these spoon-like tips, their minute limbs being perhaps entangled in the fimbriæ, when the tongue is retracted into the beak, and the insects swallowed by the ordinary process, as doubtless those are which are captured with the beak in flight. I do not thoroughly understand the mode by which liquids are taken up by a Humming Bird's tongue, though I have carefully watched the process. If syrup be presented to one in a quill, the tongue is protruded for about half an inch into the liquor, the beak resting in the pen, as it is held horizontal; there is a slight but rapid and constant projection and retraction of the tubes, and the liquor disappears very fast, perhaps by capillary attraction, perhaps by a sort of pumping, certainly not by licking.*

## CHARACTERS AND RELATIONSHIPS.

Art thou a bird, a bee, or butterfly?
"Each and all three—a bird in shape am I,
A bee collecting sweets from bloom to bloom,
A butterfly in brilliancy of plume."
—MONTGOMERY.

Humming Birds may be distinguished from all other birds by the structure of the wing alone, which is entirely peculiar in the excessive development of the primary and abbreviation of the secondary quills, the latter only six in number and not extending beyond the tip of the shortest (innermost) primary, and shorter than the longest primary coverts. The primaries are always ten in number, of which the first is longest, or at least equal to the longest, except in a single monotypic genus (*Aithurus*), and constitute much the greater part of the wing. The bill and tongue are also peculiar in their structure. The former is always slender, and when closed forms a tube by the inclosure of the under mandible between the flexible edges of the upper, the tip of both being acuminate. The tongue is slender and very extensile, like that of the woodpeckers, the two branches of the hyoid curving, when the tongue is drawn within the bill, upward around the back of the skull and then forward over the top of the head. Instead, however, of its being, as in the Woodpeckers, solid and tipped with a barbed horny point, it is hollow and divided at the tip into two slender branches, each of which is fringed on the outer margin by a thin membrane.

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* See, however, what Mr. W. H. Ballou says, on p. 287.

In all other characters, the Humming Birds possess nothing absolutely peculiar, although certain features, shared by other groups of birds, notably the Swifts (*Micropodidæ*), are developed to an extreme degree; as, for example, the very high keel to the sternum and consequent excessive development of the pectoral muscles, the short arm-wing (humerus) and extremely long hand-wing (manus), and minute feet with relatively large, strongly curved, and sharp claws. The Humming Birds and Swifts further agree in numerous anatomical characters, and there can be no doubt that they are more closely related to each other than are either to any other group of birds. In fact, except in the shape of the bill and structure of the bones of the face, the Humming Birds and Swifts present no definite differences of osteological structure.

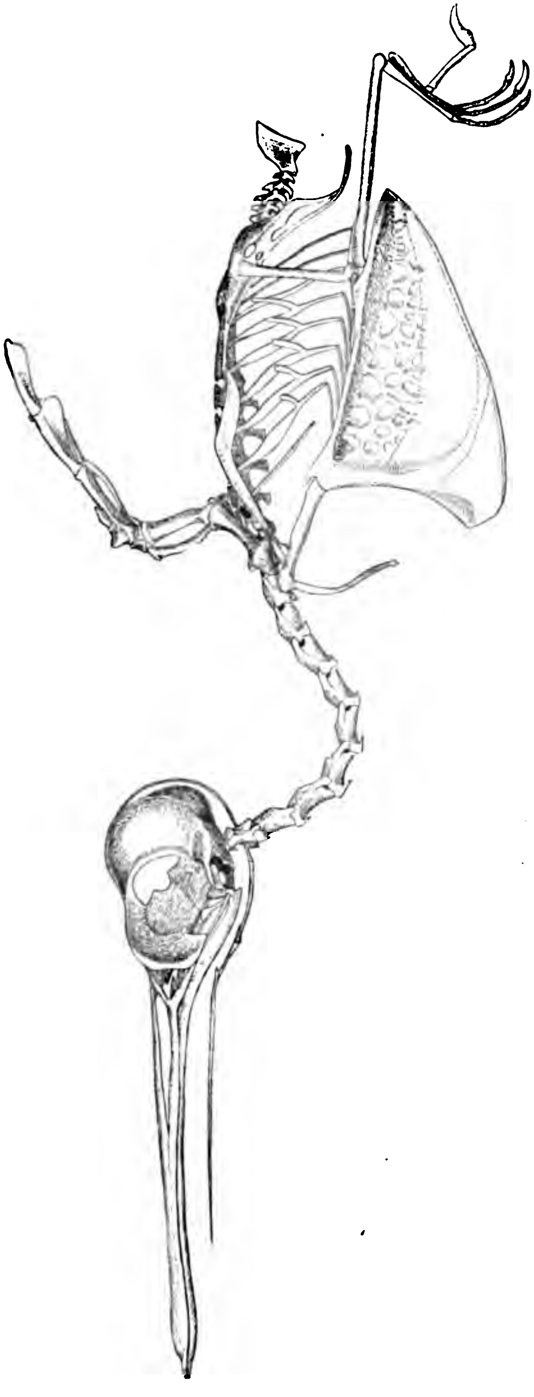
As being probably more familiar with the anatomy of Humming Birds than any other person, having made the subject one of special and painstaking investigation, Mr. Frederic A. Lucas, of the National Museum, has, at my request, prepared for this work a brief summary of the osteological and some other anatomical characters of the *Trochilidæ*, which I take great pleasure in presenting herewith:

*Pterylosis.*—The manner in which the feathers of a bird are arranged is termed its *pterylosis*; and this varies in the different groups of birds, none, save the Penguins, having the body completely and evenly covered with feathers, the plumage ordinarily being distributed in well-defined patches, known as feather-tracts or *pterylæ*, interspersed with bare spots called *apteria*.

Comparatively little is known of the pterylosis of Humming Birds, only a few out of the several hundred species having been thus described, but that of *Florisuga mellivora*, shown in the accompanying figures, does not differ materially from what has been found in other species. Like other characters, the pterylosis of Humming Birds seems to a great extent to be peculiar to the group, although both Humming Birds and Swifts agree in having the long, narrow, bare tracts down the back, and under the throat, as well as a similar disposition of the feathers on the under side of the body. Some of the Swifts, too, possess the bare space on the back of the neck, and, while this is usually quite short, yet in the species that makes the edible nests (*Collocalia fuciphaga*), and which has a very long neck, the nape tract is also long.

There is, however, one curious feature common to both these groups of birds, this being the existence of a small, naked patch near the tip of the wing, above and below, colored black. This is not known to occur at all among Passeres, and has not as yet been found in any of our small North American species of Humming Birds, although very conspicuous in many large southern forms, such as *Campylopterus*.

The pterylosis of all birds is more or less adaptive, having some direct relation to their habits, and this adaptation is well seen in Humming Birds. The bare tracts on



SKELETON of *Trochilus colubris.*
(Enlarged 2¼ times.)

the nape and along the throat allow the neck to readily lie against the middle of the back, or to bend downward over the point of the breastbone, while the bare spaces under the wing and along the sides of the body permit the wings to be easily closed and applied to the body, the side spaces conforming almost exactly to the curve of the edge of the folded wing. The large bare space on the under side, found in nearly all birds save water-fowl, is mainly to allow the warmth of the body to be directly applied to the eggs during incubation, and in birds like ducks and penguins, which are densely or completely feathered beneath, a bare spot is present during the breeding season.

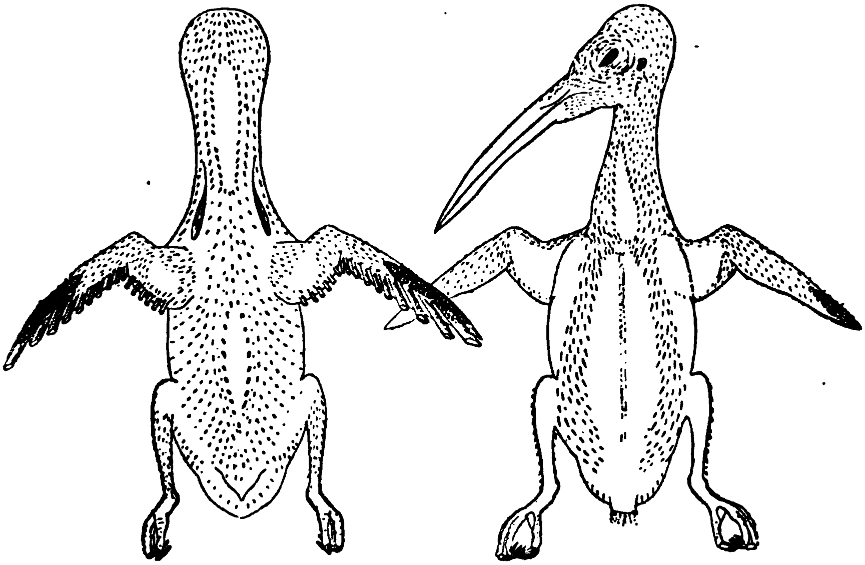


FIG. 1.—The above illustration shows the dorsal and ventral aspects of the pterylosis of a Humming Bird (*Florisuga mellivora*). A small triangular space on the crown of the head is not seen. (Natural size.)

*Skeleton.*—The most obvious features in the skeleton of a Humming Bird are the width of the front portion of the skull, long neck, short wing, and, above all, disproportionately large breastbone.

The arrangement of the bones of the palate is of the kind termed schizognathous,* and, while the skull in general shows but little to indicate relationship with other groups of birds, the base of the cranium is very Swiftlike and the palate and frontal region have some slight leanings toward the Woodpeckers.

The length of the neck may be best appreciated by saying that in Humming Birds the neck forms four-sevenths of the vertebral column, while among Swallows it forms but three-sevenths, the number of vertebræ being the same—fourteen—in each case.

Following the neck vertebræ are three free dorsal vertebræ and these are succeeded by a "sacrum" of twelve fused vertebræ, the vertebral column being terminated by six caudals.

There are eight pairs of ribs, this being an unusually large number among birds, and especially among land birds, where the ordinary number is six pairs. The first three pairs of ribs join the three free dorsals, the succeeding four pairs are attached to the first four vertebræ of the "sacral" series, while the eighth and last pair is entirely free at the upper end. The last ribs almost meet the long, slender, down-curved pubic portion of the pelvis, securely hooping in the viscera and giving an unusual air of strength to the skeleton.

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* The description here given of the skeleton is based on *Trochilus colubris*, and while this species agrees in all save very minute points with other species examined, it is to be expected that when more is known of the osteology of the Trochilidæ skeletal differences will be found to exist in the group.

The bones supporting the tail are provided with long recurved processes to furnish ample attachment for the well-developed caudal muscles, for the tail forms an important adjunct to the wings when the Humming Bird hangs poised in the air, extracting the honey from some flower.

The shortness of the wing is due to the shortened humerus, radius, and ulna, the remainder of the wing bones being rather long.

The coracoid, the bone to which the wing is hinged, has a very peculiar form among Humming Birds. In the large majority of birds, the tendon running from the muscles that raise the wing plays in a notch in the upper end of the coracoid, but in the Humming Bird this notch is bridged over and the tendon plays securely through the perforation thus formed.

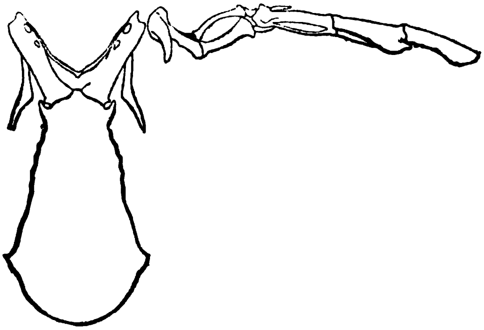

FIG. 2.—The above figure of the shoulder-girdle and attached portion of the skeleton of a Humming Bird (*Selasphorus platycercus*), seen from below, shows the coracoid with its perforations, and the extremely long bones of the hand, the figure being twice the natural size.

The legs seem small, but in reality are proportionately larger than in many other birds, the sharp, curved claws in particular being decidedly well developed.

*Skeletal affinities.*—In the number of ribs the Humming Birds are approached, but not equaled, by some Swifts, both groups agreeing in the incomplete character of the last pair when more than six pairs are present in any Swift.

The wing of the Humming Bird is largely unique in character and in minor points is intermediate between the Swifts and Passeres.

The manner in which the coracoid joins the sternum—by a shallow cup-and-ball joint—is peculiar to Swifts and Hummers.

In the character of the sternum and the manner in which the ribs are attached to its sides the two groups are nearly alike, while the posterior limbs of both agree in many particulars.

*Generalizations.*—Skeletal modifications are of two kinds, technically termed morphological and physiological, the former depending on the relationships of the animal the latter on its habits.

In order to better understand the skeleton of the Humming Bird, the form of the feathered wing and mode of its flight should continually be borne in mind, for the Humming Bird is emphatically a bird of the air, and all its parts are modified accordingly.

The external wing is characterized by the great development of the primaries and almost complete functional suppression of the secondaries, while the wing beats are frequent and all movements of the bird sudden. Just how rapid the wing beats are must for the present be merely a matter of conjecture, but it can be said that the

Gannet, a bird of moderately slow stroke, makes ordinarily one hundred and fifty strokes a minute, and that judging from the appearance of a small wheel driven at the rate of a thousand revolutions a minute the wings of a Humming Bird make not far from five hundred vibrations in the same short space of time.

So great an exercise of muscular power as that involved in such rapid movements necessarily causes rapid waste of tissue and calls for an ample supply of blood, and we find that this is provided for by a remarkable large heart.*

The actual speed of the Humming Bird is less than the ordinary observer might suspect, for the small size of the creature adds to the seeming rapidity of its flight, just as the little puffing tug appears to move faster than the ferryboat, although it really does not do so.

The wing and flight of a Humming Bird are comparable to the wing and flight of a fly, or, better still, a Hawk Moth, both possessing a rigid wing driven at a high rate of speed, and both possessing the ability to hang suspended in the air or to dart erratically about in a manner that defies the eye to follow.

Rapidity in the stroke of the wing is gained by shortening the upper arm bones, the bones of the hand on the contrary being lengthened to support the shafts of the large primaries. The inner portion of the wing is furthermore shortened, and speed consequently gained, by flexing the forearm, and examination of a bird in the flesh will show that it is quite impossible for a Humming Bird to extend its wings as do other birds.

The wing of a bird is a lever of the third order, and since the power is applied at a disadvantage, any increase of speed calls for corresponding increase in driving power, which in a bird means larger pectoral muscles and a larger breastbone. Now the sternum of a Humming Bird is, relatively to the size of the bird, by far the largest in the entire class of birds, and although the proportion of length to depth of keel is equaled in some Swifts, it must be remembered that the sternum of a Humming Bird is not only deep, but long, running nearly the entire length of the body. The increased size of the pectoral muscles not only adds to the power of flight, but to the stability of the bird, for the weight, like the ballast of a cutter yacht, is thus brought low down.

All attachments to the wing muscles are large, and when the humerus is magnified to the size of that of a Swift it is seen to be the more rugose of the two. At first sight the breastbone might appear too thin to resist the strain of the muscles it supports, but these being arranged in pairs pull as it were one against the other, thus relieving the sternum of the strain that would otherwise be brought upon it.

In short, the Humming Bird is a piece of mechanism most admirably adapted for flight, and wonderful as are the modifications of plumage in various members of the group, no less remarkable is the adaptation of the skeleton for the most rapid and remarkable aërial maneuvers.

*Description of the tongue.*—The tongue of the Humming Bird, like that of the Woodpecker, is extremely long, but the two differ decidedly in their structure, and the muscles by which the tongue is protruded and retracted are applied in a totally different manner in the two birds.

The free portion of the tongue is divided for about half its length, and when withdrawn lies just within the lower mandible. Toward the base it consists of a somewhat flattened tube of dense cartilage, grooved along the center above and below, and with a slighter groove on the upper exterior surface. This single tube divides before reaching the forked part of the tongue, and a flange is developed along the outer edge. This flange, or border, becomes membraneous, and seems to curl upward and inward, converting the forked tip into two tubes or gutters. That these serve for the passage of nectar from flowers seems a little doubtful, the peculiar modification of the tongue probably being for the capture of minute insects. The anterior half of this membraneous flange is more or less fringed, as noted by Gosse and others, but how much of this fimbriation is normal and how much is due to the whipping out of the membrane by use is not quite evident. That some of the fimbriation is due to wear is certain from its appearance under the microscope.

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* According to Mr. G. Gulliver (in Proceedings of the Zoölogical Society of London, 1846, p. 28), the blood-corpuscles of a Humming Bird (species not stated) measure $\frac{1}{2666}$ by $\frac{1}{4000}$ of an inch, the long diameter of the nucleus being very nearly $\frac{1}{4000}$ of an inch; the temperature of the blood about 105°.—R. R.

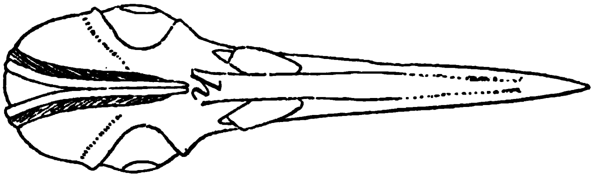

FIG. 3. The accompanying figure of the head of a Humming Bird (*Eulampis holosericeus*), seen from above, shows the termination of the hyoid, or tongue, bones *h*. The shaded bands indicate the muscles which retract the tongue. (The figure is twice the natural size.)

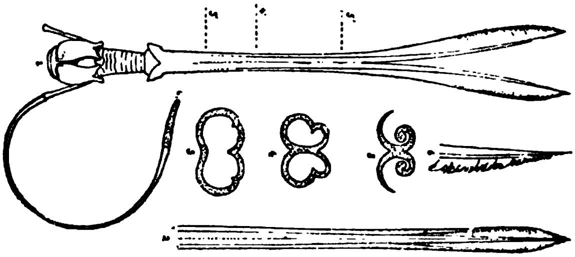

FIG. 4. The accompanying figures, showing details in the structure of the tongue of a Humming Bird (*Eulampis holosericeus*), may be described as follows:

No. 1 shows the tongue, twice the natural size, with the free portions separated and the membrane spread out.

No. 2 shows the anterior portion of the tongue, greatly enlarged, with the membraneous fringe curled up, as in life.

Nos. 3, 4, and 5 are sections through the tongue at 3′, 4′, and 5′, greatly enlarged.

No. 6 represents the termination of one of the free portions of the tongue very much enlarged.

## VARIATIONS.

The range of variation in the details of form or external structure, size, and coloration in the Humming Birds is very great—perhaps more so than in any other group of coördinate rank among birds, this variation affecting chiefly the bill, as to its proportionate length and whether straight or curved, and if curved to what degree and in what direction; the tail (which, however, always consists of ten rectrices?)*, in the relative length of different feathers, one or more pairs of which are sometimes singularly or even extraordinarily developed or aborted; and the wing, as to the shape of the outer primary and the thickness of its shaft. These variations are so complex, however, that it will be best to treat of them under distinct headings. Indeed "it is the great diversity of form in this family of birds," says Mr. Gould, "which renders the study of them so very interesting. If these little objects were

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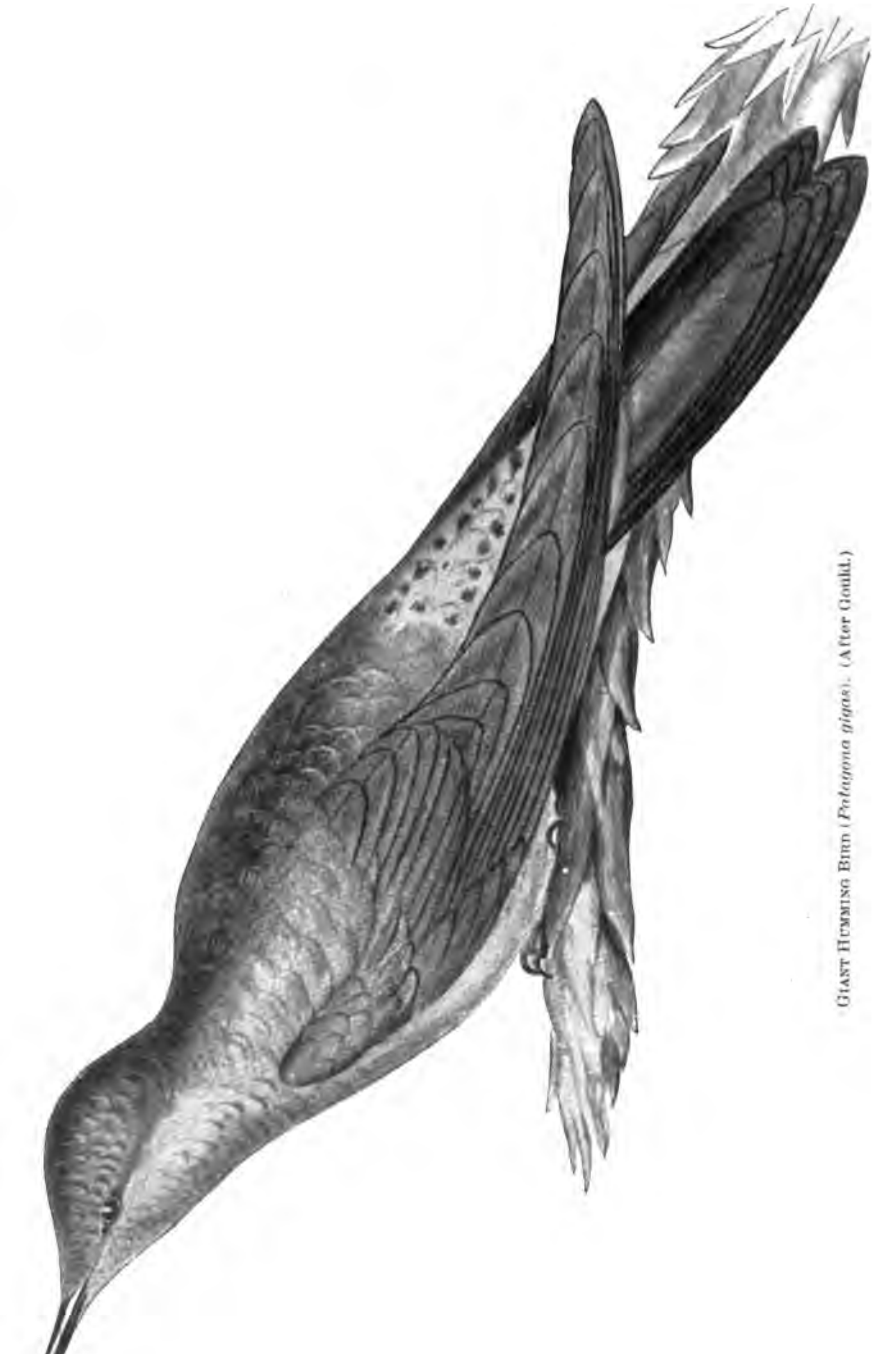
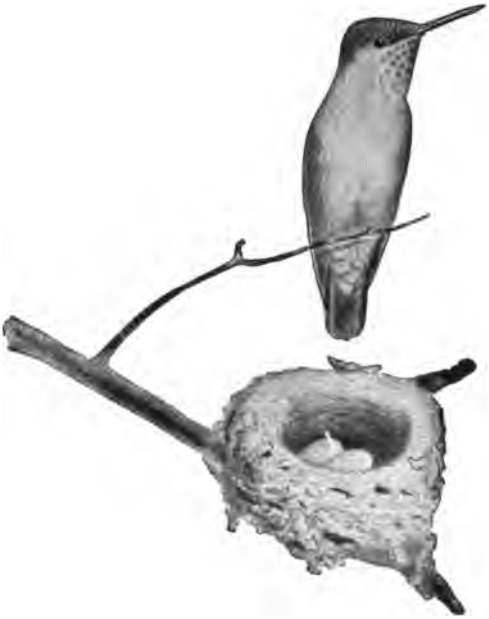
* See remarks as to this on page 300.



GIANT HUMMING BIRD (*Patagona gigas*). (After Gould.)



VERVAIN HUMMING BIRD (*Mellisuga minima*).
Male. (Cat. No. 30274, U. S. N. M. Jamaica. Collected by W. T. March.)
Nest and eggs. (Cat. No. 3426, U. S. N. M. Jamaica. Collected by W. T. March.)

magnified to the size of eagles, their structural differences would stand out in very bold relief, and the many marked generic distinctions they present would be far more clearly perceptible."

*Variations in size.*—The variation in size, while very considerable, is not greater than in some other groups of birds, as, for instance, the diurnal birds of prey and the crow family. While as a family, or group, the Humming Birds are the smallest of birds, many kinds are considerably larger than the smallest Passerine birds, as the Kinglets, Creepers, and smaller Wrens; while, owing to their shorter, more scale-like feathering, and greater compactness of body, many Humming Birds far exceed in actual bulk and weight the above-mentioned members of the Oscinine Sub-Order.

The giant of Humming Birds is the *Patagona gigas*, a plainly colored species inhabiting the higher portions of the Andes range (from Chile to Ecuador), which in bulk equals a good-sized Swift, being about 8½ inches in length, with the wing 5 inches or more and the tail nearly 4 inches. The smallest known species is Princess Helena's Humming Bird (*Calypte helenæ*, GOULD), of Cuba, the entire bulk of which is much less than the head alone of the Giant Hummer, the total length being only about 2¼ inches. The distinction of being the smallest among birds has usually been accorded to the Vervain Humming Bird (*Mellisuga minima*), of Jamaica, but that it is considerably larger than the Cuban *Calypte*, the following comparative measurements will show:

| | Wing. | Tail. | Exposed culmen. |
|---|---|---|---|
| *Calypte helenæ*, male........ | 1.10-1.15 | 0.65 | 0.40 |
| *Mellisuga minima*, male .... | 1.40-1.48 | 0.82-0.85 | 0.38-0.40 |

We are fortunately able to show, in the accompanying plates, full-length, natural-size drawings of the Giant and Vervain Hummers, the latter with its nest and eggs.*

The nest of the Vervain Humming Bird measures only about three-fourths of an inch in diameter across the cavity, and a little more than an inch in total diameter, while the eggs are only about 0.28 of an inch in length by 0.20 of an inch in width.

The accompanying illustration shows the male and the nest and eggs of this species, natural size.

*Variations of the bill.*—The extremes of length in this member are represented in the genera *Docimastes* and *Rhamphomicron*, in both of which it is straight. In the former it exceeds in length the combined length of the head, neck, body, and tail of the bird itself, being sometimes as much as 4¼ (or according to Mr. Gould, sometimes more than 5) inches in extent. In the smallest species of the latter genus, *R.*

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* The discovery that *Calypte helenæ* is smaller than *M. minima* was not made until after the drawing of the latter was completed.

*microrhynchum*, it is only a quarter of an inch in length. “The bill of *D. ensifer*, which is more than 5 inches long, and which contains a tongue capable of being protruded nearly as far beyond its tip, is most admirably fitted for the exploration of the lengthened and pendent corrollas of the *Brugmansiæ*, while the short-billed *Lesbiæ* cling to the upper portion of those flowers, pierce their bases, and with the delicate feelers at the extremities of the tongue, readily secure the insects which there abound.”

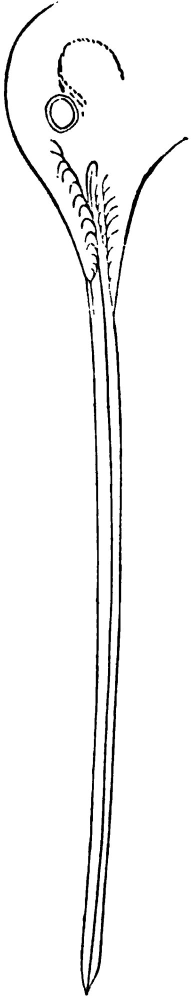

FIG. 5.—Head of *Docimastes ensiferus.*

In the various genera there is every gradation from a perfectly straight bill to one that is decidedly curved or arched; but in one genus (*Eutoxeres*) it is so greatly decurved as to constitute almost one-third of a circle, thus justifying the very appropriate name of Sickle-billed Hummers, by which the birds of this genus are known. This variation in the length and shape of the bill, it may be remarked, is necessitated by some peculiarity of the flower in which, chiefly or exclusively, the bird seeks its food. For example, the excessively lengthened beak of the “sword bearer” (*Docimastes*), as explained above, is necessary for reaching the honey-glands of very long trumpet-shaped blossoms, while the hook-like beak of the “sickle bill” is evidently designed for insertion into the curved throat of certain orchids, palms, or other flowers of unusual form.

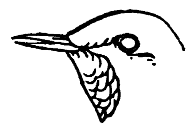

FIG. 6.—Head of *Rhamphomicron microrhynchum.*

The manner in which the Sickle-billed Humming Bird feeds is thus described by Dr. J. King Merritt in the Annals of the Lyceum of Natural History of New York, vol. 6, p. 139:

> One day, while out hunting a short distance from camp, I was startled by the swift approach of a small object through the dense thicket, which darted like a rifle-bullet past me, with a loud hum and buzzing of the wings. Indeed it was this great noise that accompanied its flight that especially attracted my attention as something uncommon.
>
> The bird continued its flight but a short distance beyond the spot where I stood, when it suddenly stopped in its rapid course directly in front of a flower. There for a moment poising itself in this position it darted upon the flower in a peculiar manner; in fact, the movements which now followed were exceedingly curious. Instead of inserting its beak in the calyx by advancing in a direct line toward the flower, as customary with this class of birds, this one performed a curvilinear movement, at first stooping forward while it introduced its beak into the calyx, and then, when apparently the point of the beak had reached the desired locality in the flower, its body suddenly dropped downwards, so that it seemed as though it was suspended from the flower by the beak. That this was not actually the case the continued rapid movement of its wings demonstrated beyond a doubt. In this position it remained the

> ordinary length of time, and then, by performing these movements in the reverse order and direction, it freed itself from the flower, and afterwards proceeded to the adjoining one, when the same operation was repeated as already described.

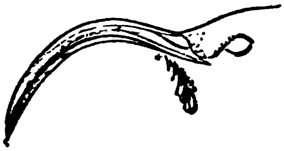

Fig. 7—Bill of *Eutoxeres aquila.*

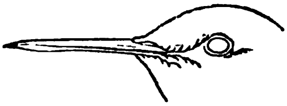

Fig. 8—Bill of *Heliotrypha exortis.*

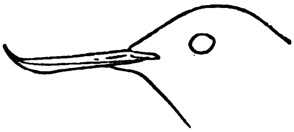

Fig. 9—Bill of *Avocettula recurvirostris.*

> The flower resembles somewhat in form the Roman helmet inverted, and is attached, as it were, by the point of the crest to the stalk.

Regarding the recurved bill of *Avocettula*, the use for which it is adapted is thus conjectured by Mr. Swainson:

> The extraordinary formation in the bill of this beautiful little creature, is without parallel in any land bird yet described, and presents in miniature a striking resemblance to that of the avoset. It is almost impossible to conjecture rightly the use of this singular formation; but it appears to me not improbable, that the principal sustenance of the bird may be drawn from the pendent bignonaceæ, and other similar plants, so common in South America, whose corollæ are long, and generally bent in their tube; the nectar being at the bottom, could not be reached either by a straight or a curved bill, though very easily by one corresponding to the shape of the flower.

Another distinct type of bill is the wedge-shaped, seen in the genera *Heliothrix* and *Schistes*, in which the terminal portion (almost the terminal half in *Heliothrix*) is very much compressed, the tip, when viewed from above, forming the finest possible point, as shown below:

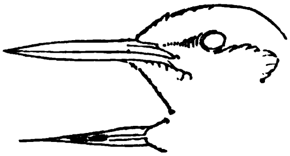

Fig. 10—Bill of *Heliothrix auritus*, showing the extremely compressed tip, *a* being a vertical view.

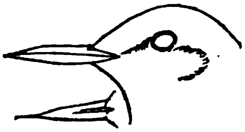

Fig. 11—Bill of *Schistes personatus.*

Some genera which, instead of extracting their food from flowers, feed upon spiders and other insects, while hovering in the usual manner, which they snatch from the under surface of leaves or from the branches of trees, have the tip of the bill hooked, and the edge of the mandible finely toothed or fringed near the tip, the better to secure their prey.

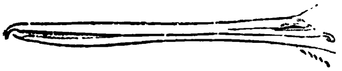

Fig. 12—Bill of *Androdon æquatorialis.*

The nostrils are situated at the base of the upper mandible, on each side, and are overhung by a distinct scale or operculum. Sometimes this latter is wholly uncovered, and is then very conspicuous; but oftener it is entirely hidden by short imbricated feathers, entirely concealing the nostrils or else permitting them to be seen only as a narrow slit beneath the lower edge of the feathering.

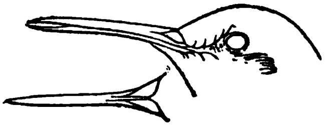

FIG. 13.—Head of *Hylocharis sapphirina*, showing naked nostrils, with overhanging membrane.

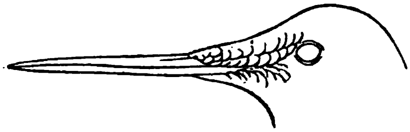

FIG. 14.—Head of *Eugenia imperatrix*, showing dense feathering over nostrils.

*Variations in the form of the wing.*—As already stated (see page 289), the first primary is invariably the longest, except in two genera, *Aithurus*, in which it is decidely shorter than the second, and *Atthis*, in which the first and second are about the same length.

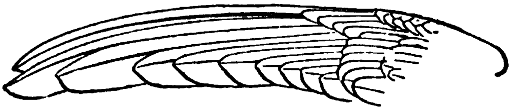

FIG. 15.—Wing *Aithurus polytmus*.

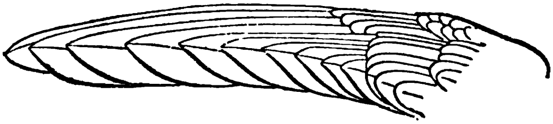

FIG. 16.—Wing of *Hylonympha macrocerca*.

Usually, the outer primary is not different in shape from the second; but occasionally it is quite different, as in the genera *Lafresnaya* and *Agœlactis*, in which it is very narrow for the entire length, the tip curved inward or upward; and in certain species of *Selasphorus*, in which the tip is contracted and curved outward, as shown in the accompanying diagrams:

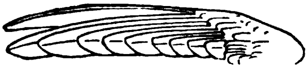

FIG. 17.—Wing of *Atthis ellioti*.

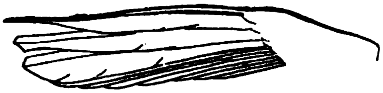

FIG. 18.—Primaries of *Selasphorus platycercus*. (Under side showing peculiar form of first and second quills.)

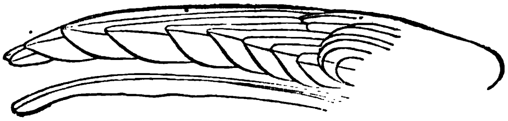

FIG. 19.—Wing of *Lafresnaya flavicaudata*.

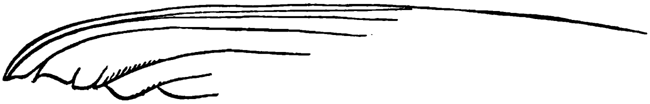

FIG. 20—Wing of *Aglœactis cupripennis*. (Under side, showing very narrow outer quill.)

Ordinarily, there is a regular gradation in the size and shape from the first to the tenth primary; but sometimes this is not the case, the male of the common Ruby-throated Humming Bird (*Trochilus colubris*) affording a conspicuous example. In this, the six innermost quills are not only abruptly much smaller than the others, but they are quite differently shaped at their tips (see Fig. 21).

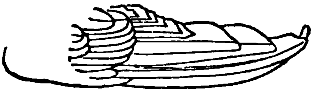

FIG. 21.—Wing of *Trochilus colubris*, adult male.

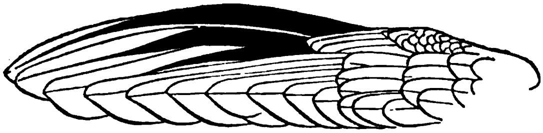

FIG. 22.—Wing of *Sphenoproctus pampa*, to show excessively thickened shafts of three outer primaries.

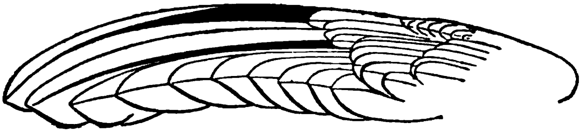

FIG. 23.—Wing of *Eupetomena macroura*.

Although the shafts of the primaries are always hard and strong, to enable them to endure the rapid vibrations to which they are subjected during flight, they are not often conspicuous for their unusual thickness. In some genera, however, they are thus extraordinarily developed, in *Sphenoproctus* and some species of *Campylopterus*, for example, appearing almost like a monstrosity or abnormal swelling, as shown in (Figs. 22 and 25), which is accompanied by others (Figs. 23 and 24) to show the gradual transition through which this excessive development is reached.

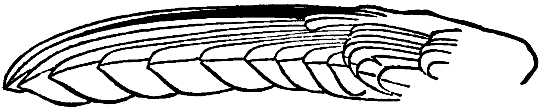

FIG. 24.—Wing of *Aphantochroa cirrhochloris*.

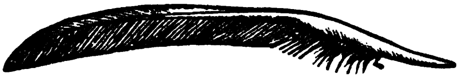

FIG. 25.—Outer primary of a species of *Campylopterus*, showing thickened shaft.

*Variations in the form of the tail.*—The number of tail-feathers is usually, perhaps always, ten. One species, the Marvellous Humming Bird (*Loddigesia mirabilis*), is said to possess only four; but, although I have not seen the bird in question, I can not help thinking that the apparently absent rectrices are aborted and confounded with the coverts.* Certainly in at least one other genus (*Myrtis*), such an abortion of the middle pair of tail-feathers is very evident, these being so much reduced in size as to be entirely concealed by the upper tail-coverts.† On the other hand, another genus (*Florisuga*) seems to possess twelve tail-feathers; but a close examination will show that what are apparently the middle pair of rectrices are in reality the two longest upper tail-coverts.

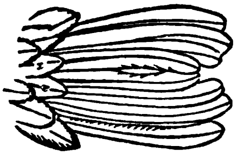

FIG. 26.—Tail of *Myrtis fanny*, showing aborted middle rectrices (*x x*), the upper tail-coverts being parted to expose them to view.

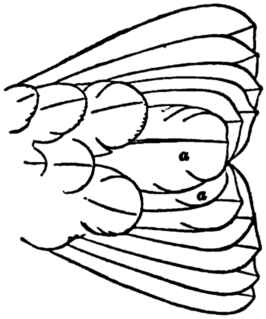

FIG. 27.—Tail of *Florisuga mellivora*, showing specialized pair of upper coverts (*a a*).

The shape and development of the tail-feathers in the Humming Birds vary to a degree that has no parallel among other birds, many of the forms assumed being also entirely unique. Much the larger number of species have the tail of a shape not very different from the ordinary types among birds, that is to say, moderately rounded or forked, or nearly even; but besides tails of a normal shape there are deeply forked or forficate (scissors-shaped) tails, graduated or wedge-shaped tails, double-rounded and double-emarginated tails, tails with streamers, tails with racket- or paddle-shaped feathers, and tails whose shape can not be designated by any special term. Putting aside those which depart least from the ordinary shapes, the different types, with their variations, are illustrated by the figures composing Plates XVIII–XXIV.

*Variations in development of the tail-coverts.*—Excepting the case of *Florisuga*, referred to above, there are few notable modifications of the tail-coverts. Two genera, however, may be mentioned which have these feathers conspicuously developed, the one as to size, the other as to

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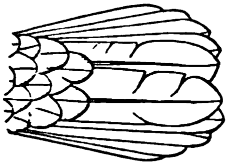
* In *Acestrura micrura*, according to Mr. Gould, all the rectrices are thus aborted, the entire tail being concealed by the coverts.

† Gould also cites as examples *Thaumastura cora* and *Doricha enicura*; but in these species the middle pair of rectrices while very short are not wholly hidden by the coverts, as is the case in *Myrtis fanny*. (See Plate XXIV, Fig. 1, and Plate XXII, Fig. 1).



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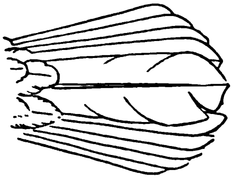

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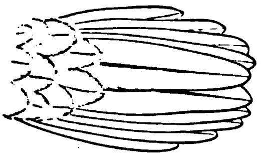

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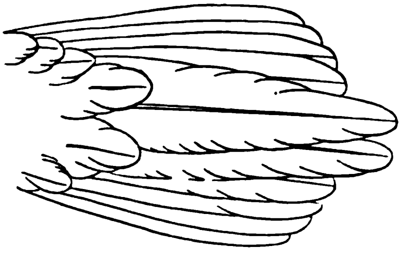

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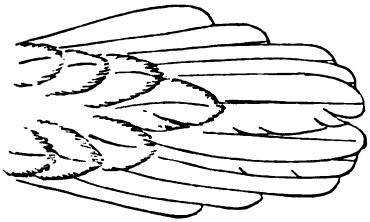

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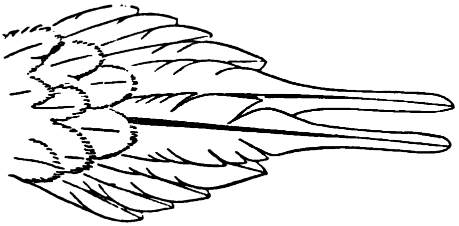

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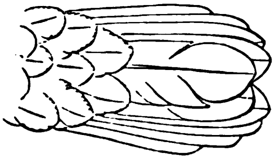

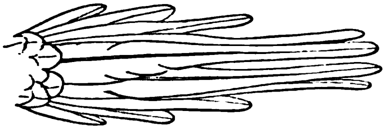

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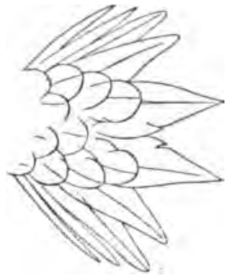

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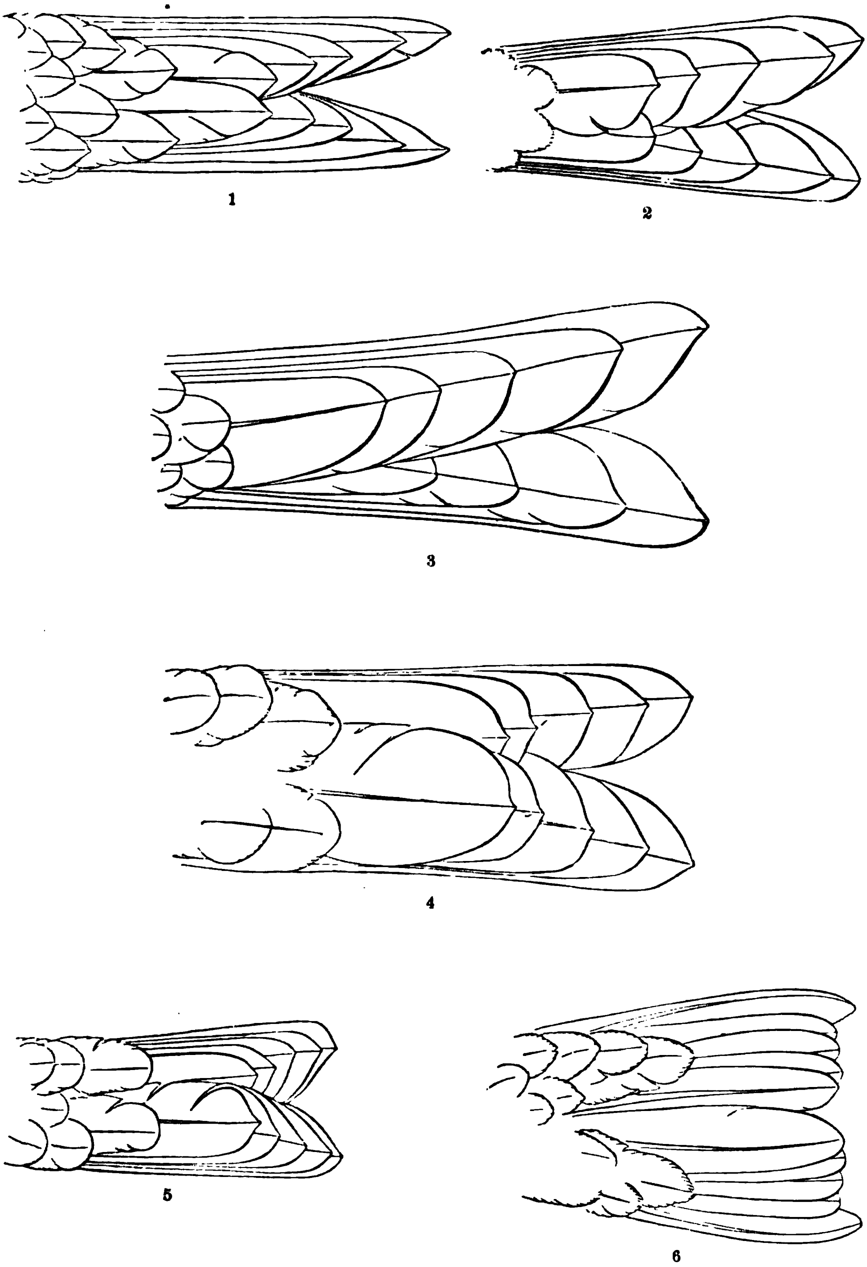
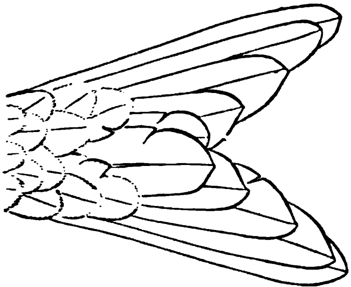
## OUTLINES OF TAILS OF HUMMING BIRDS.

Fig. 1. *Phlogophilus hemileucurus.*
Fig. 2. *Schistes geoffroyi.*
Fig. 3. *Sphenoproctus pampa.*
Fig. 4. *Juliamyia julie.*
Fig. 5. *Phaëthornis superciliosus.*
Fig. 6. *Heliothrix auritus.*
Fig. 7. *Leucochloris albicollis.*
Fig. 8. *Selasphorus alleni.*
Fig. 9. *Heliactin cornuta.*



OUTLINES OF TAILS OF HUMMING BIRDS.

Fig. 1. *Docimastes ensiferus.*
Fig. 2. *Heliodoxa jacula.*
Fig. 3. *Oreonympha nobilis.*
Fig. 4. *Pterophanes temmincki.*
Fig. 5. *Helianthea typica.*
Fig. 6. *Oreotrochilus pichincha.*



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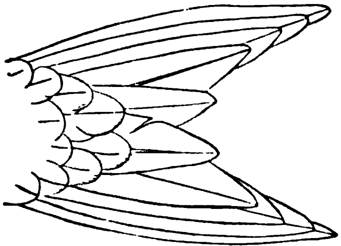

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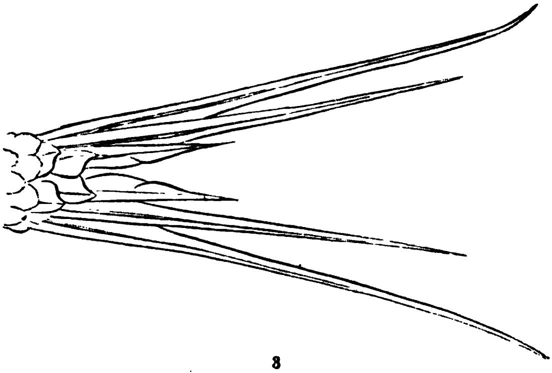

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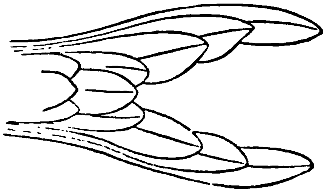

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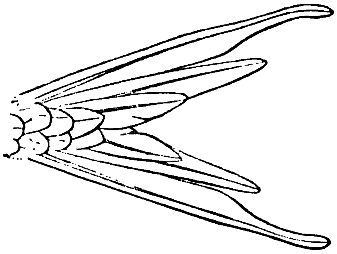

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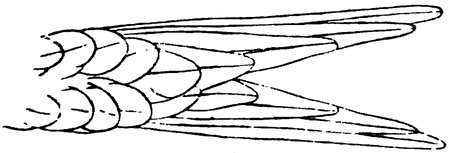

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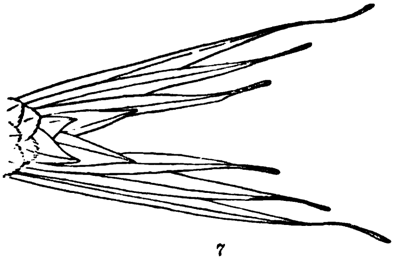

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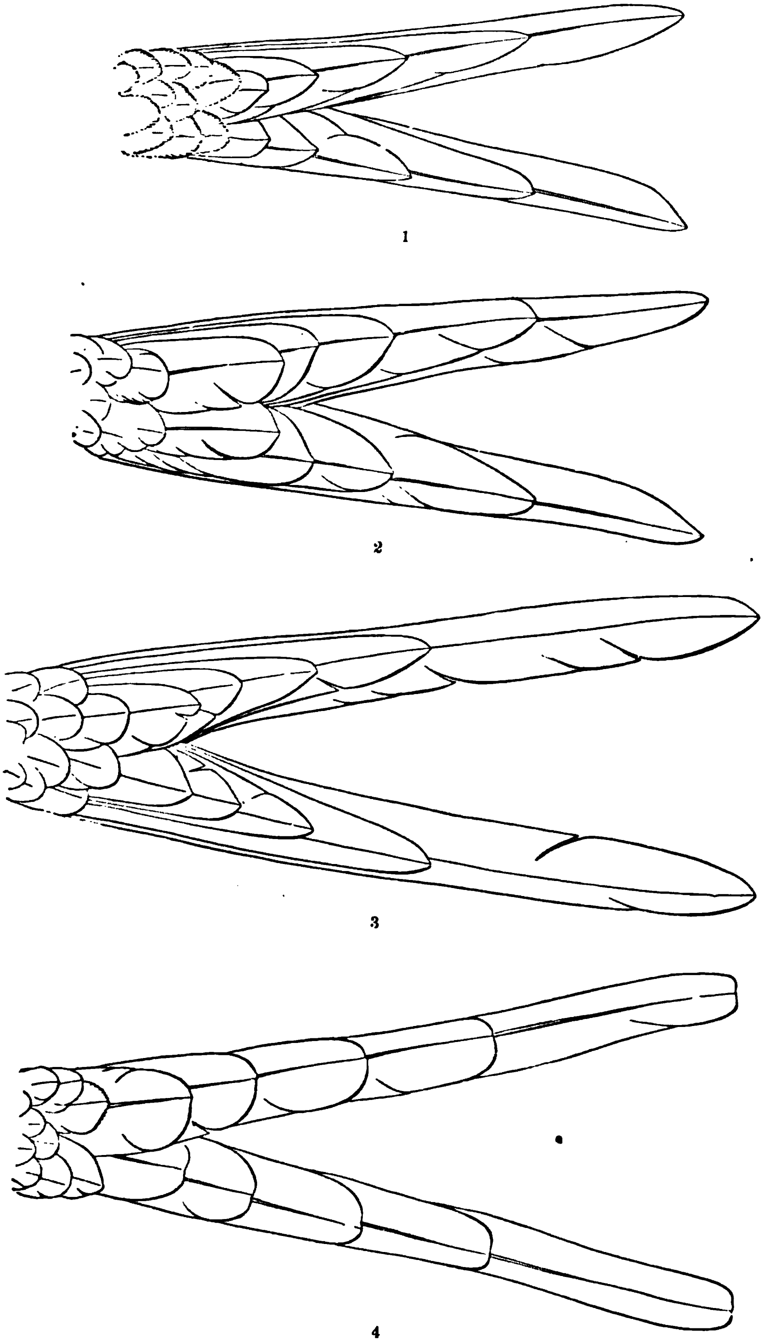
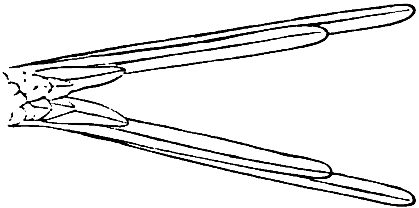
OUTLINES OF TAILS OF HUMMING BIRDS.

**Fig.** 1. *Sporadinus elegans.*
**Fig.** 2. *Heliomaster furcifer.*
**Fig.** 3. *Popelairia langsdorfi.*
**Fig.** 4. *Ptochoptera iolæma.*
Fig. 5. *Tilmatura duponti.*
Fig. 6. *Rhodopis vesper.*
Fig. 7. *Popelairia conversi.*



OUTLINES OF TAILS OF HUMMING BIRDS.

Fig. 1. *Eugenia imperatrix.*
Fig. 2. *Eupetomena macroura.*
Fig. 3. *Hylonympha macrocerca.*
Fig. 4. *Sappho sparganura.*



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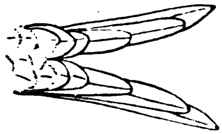

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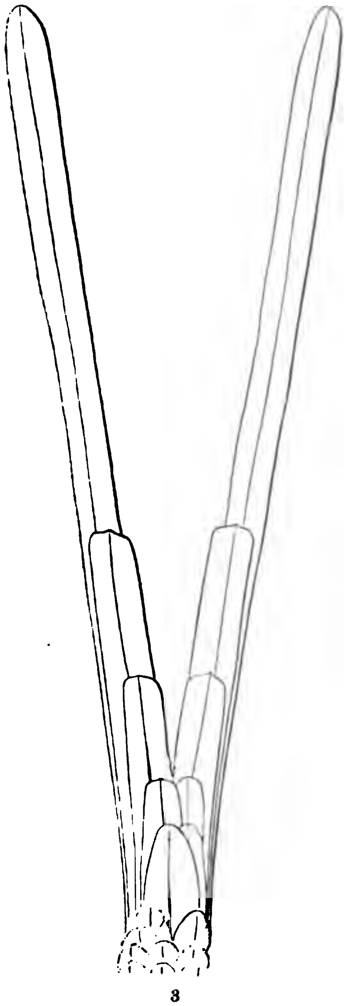

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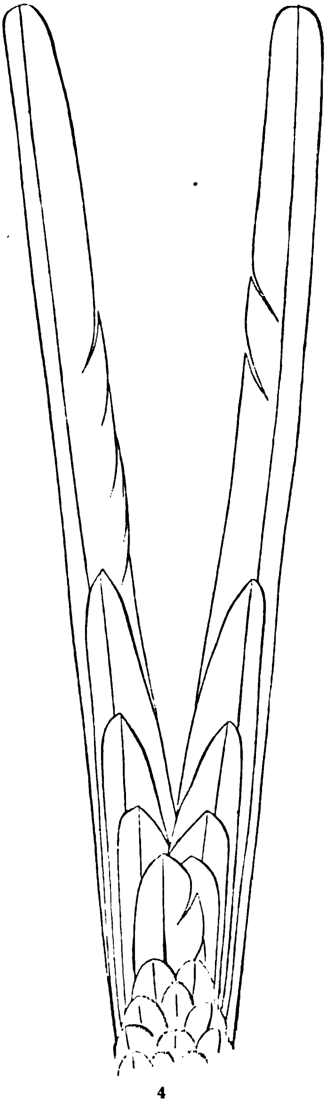

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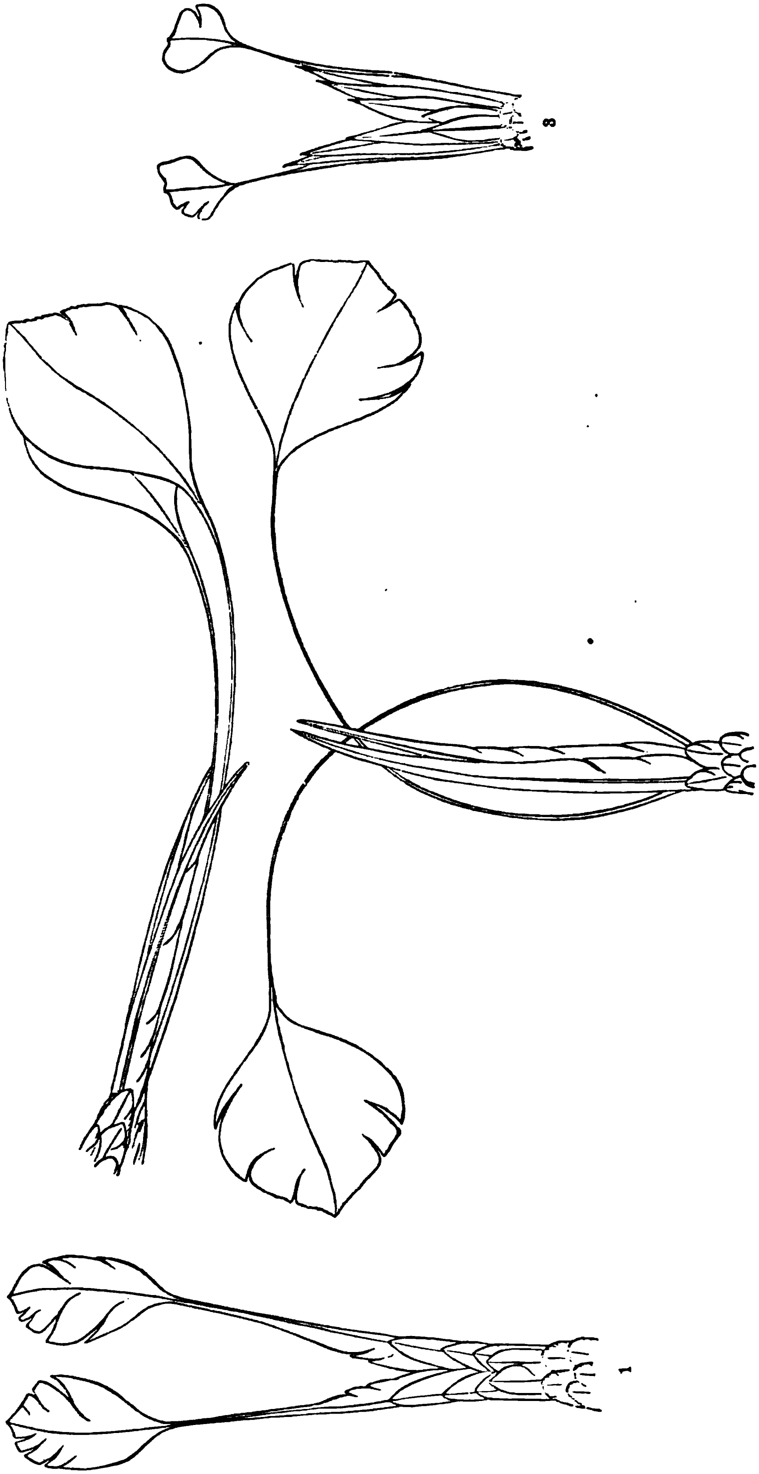
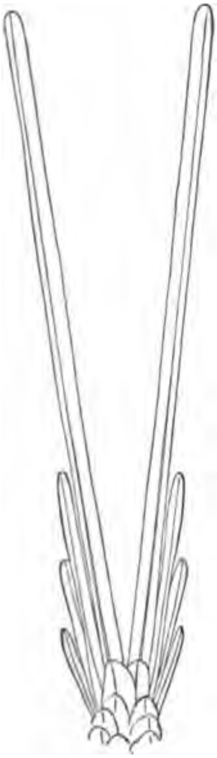
OUTLINES OF TAILS OF HUMMING BIRDS.

Fig. 1. *Doricha enicura.*
Fig. 2. *Calliphlox amethystina.*
Fig. 3. *Lesbia nuna.*
Fig. 4. *Cyanolesbia forficata.*



OUTLINES OF TAILS OF HUMMING BIRDS.

Fig. 1. *Steganura underwoodi.* Fig. 2. *Loddigesia mirabilis.* Fig. 3. *Discosura longicauda.*



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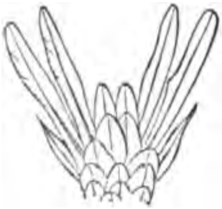

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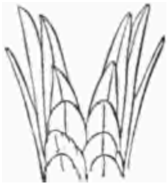

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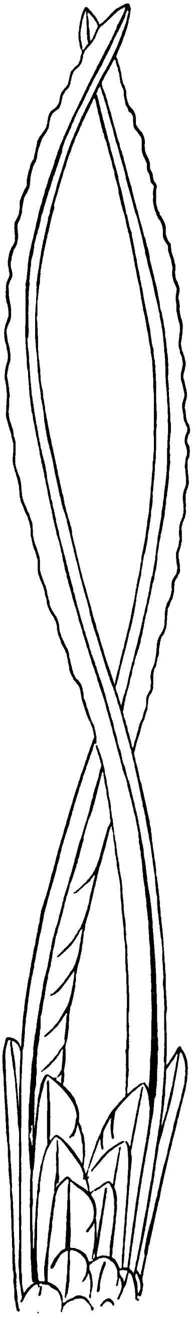

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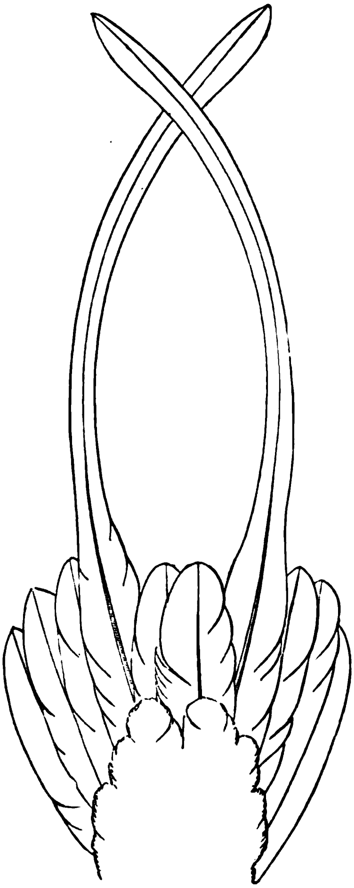

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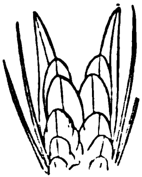

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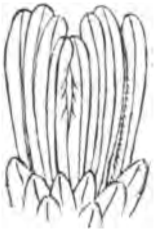

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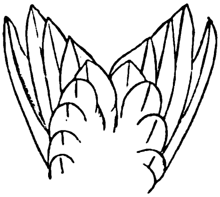

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OUTLINES OF TAILS OF HUMMING BIRDS.

Fig. 1. *Thaumastura cora.*
Fig. 2. *Chætocercus jourdani.*
Fig. 3. *Calothorax lucifer.*
Fig. 4. *Aithurus polytmus.*
Fig. 5. *Topaza pella.*
Fig. 6. *Acestrura mulsanti.*
Fig. 7. *Myrtis fanny.*
Fig. 8. *Trochilus colubris.*

form. These are *Eulampis*, in the species of which the upper tail-coverts are large, broad, and rounded, covering more than half of the tail and very billiantly colored, and *Chalybura*, in which the under tail-coverts have very downy and decomposed webs, thus somewhat resembling miniature ostrich plumes.

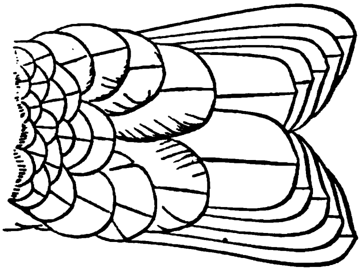


FIG. 28.—Tail of *Eulampis jugularis*, showing enlarged upper coverts.

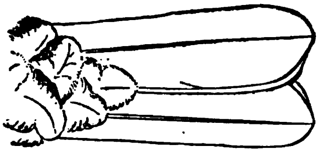


FIG. 29.—Tail of *Chalybura buffoni*, showing plume-like under coverts.

HEAD ORNAMENTS, ETC.

Of all birds only the Birds of Paradise can rival the Humming Birds in the extraordinary development of portions of their feathering. Unusual developments of the tail have already been described (see page 300), as have also occasional modifications of the tail-coverts; but there remains to be specially mentioned the various kinds of head ornaments with which the males of many species are adorned. The most frequent head ornament of the Humming Birds is a "gorget" or patch of imbricated feathers covering the throat of the male, the color of which is usually brilliantly metallic and very different from that of other portions of the bird's plumage. This gorget is well shown in the male of the common Ruby-throated Humming Bird (*Trochilus colubris*), in which the feathers on the sides of the throat are only slightly elongated. In other genera (as for example *Myrtis*) these feathers are of uniform length, while in others, notably *Calothorax* and *Acestrura* and some species of *Selasphorus* and *Calypte*, the lateral feathers of the gorget are greatly elongated, forming a conspicuous ruff on each side of the throat, as shown in figures 32–36. In the genus *Stellula* the feathers of the ruff, instead of being rounded and scale-like, are narrow and lengthened—almost lanceolate—the individuality of each one being strengthened by the peculiar coloration, the tips being metallic purple and the basal portion snow-white. (See Fig. 35.)

Of all the gorgeted Humming Birds by far the finest are the two species of the genus *Calypte* which inhabit parts of Mexico and California and the single one found in Cuba. In these birds not only is the gorget, with its elongated lateral extensions, but the whole top of the head also, of the most brilliant imaginable metallic red or violet (according to the species); indeed, as Mr. Gould truly says, these birds "are unequaled for the rich metallic brilliancy of certain parts of their plumage by any other members of the family," the color of the head and ruffs being "as glitteringly resplendent as if they had been dipped in molten metal."

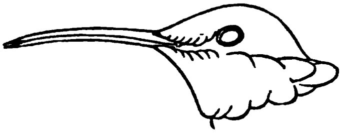


Fig. 32.—Head of *Calothorax lucifer*, ♂.

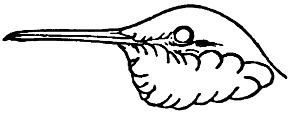


Fig. 33.—Head of *Trochilus colubris*, ♂.

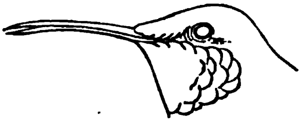


Fig. 34.—Head of *Myrtis fanny*, ♂.

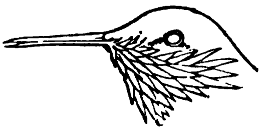


Fig. 35.—Head of *Stellula calliope*, ♂.

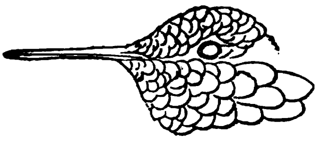


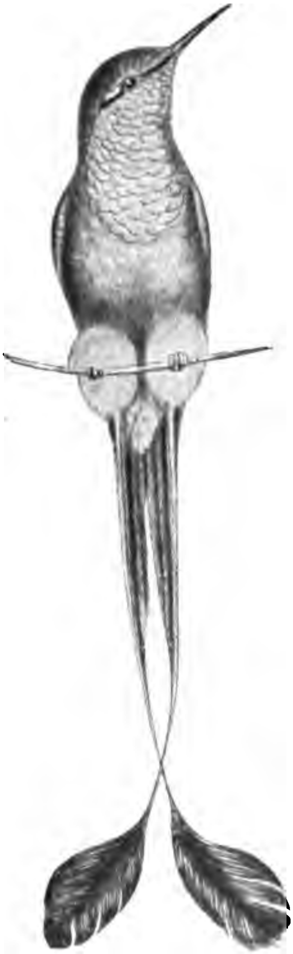
Fig. 36.—Head of *Calypte anna*, ♂.

In all the gorgeted Humming Birds except the genera *Atthis* and *Tilmatura* the males have the tail either plain purplish dusky or else varied only with rufous (as in the species of *Selasphorus*), the middle pair of feathers, however, usually shining green, like the back. The females all have the tail not only different in form but also totally different in coloration; the feathers, except the middle pair (sometimes two middle pairs), having a white tip, preceded by a subterminal band or space of blackish, the basal portion being green or rufous. This type of coloration, however, characterizes both sexes in the genus *Atthis*, which otherwise appears closely related to the genera *Trochilus*, *Selasphorus*, and *Calypte*. In *Tilmatura* the tail feathers are strikingly marked with alternate patches of black, white, and rufous.

Other genera have instead of the typical humming-bird gorget a beard-like tuft depending from the middle of the throat, and usually very brilliantly metallic in coloration. The extreme forms which this beard-like tuft assume are shown by the accompanying figures.

The fantastic markings, towering crests, and lengthened beards of the species of *Oxypogon*, says Mr. Gould, render these birds very conspicuous objects notwithstanding their plain coloration.

Crests are comparatively uncommon among the Humming Birds, only nine of the more than one hundred genera containing species which are



**WHITE-BOOTED RACKET-TAIL** (*Steganura underwoodi*). (After Gould.)

crested. These are *Aithurus*, *Heliactin*, and *Chrysolampis*, of one species each; *Polemistria* and *Cephallepis*, of two species each; *Bellona*, with two or three; *Oxypogon*, consisting of three species, and *Lophornis* and *Popelairia*, each with several species, but only a part of them furnished with crests. Altogether there are only about twenty of the five hundred species, or a little more than 4 per cent. of the whole number, that are crested, or only about one to every five species the males of which possess a metallic gorget.*

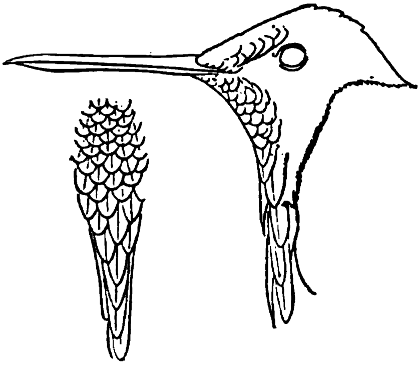


FIG. 37.—*Oreonympha nobilis.*

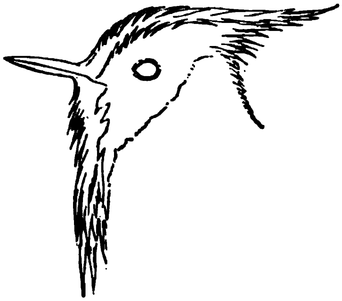


FIG. 38.—*Oxypogon lindeni.*

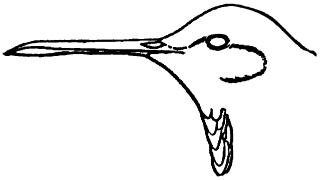


FIG. 39.—*Augastes lumachellus.*

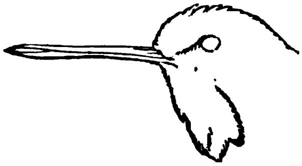


FIG. 40.—*Urosticte benjamini.*

*Aithurus* and *Heliactin* possess a double crest springing from each side of the hinder crown or occiput. In the two genera, however, these ornaments are quite different in form, as may be seen by the accompanying cuts (Figs. 41, 42), and still more so in their coloration, those of *Aithurus* being deep, velvety black while those of *Heliactin* are of the most brilliant possible metallic gold, changing to fiery scarlet or crimson towards the bases of the feathers.

The closely related genera *Chrysolampis* and *Bellona* have intensely brilliant crests covering the whole top of the head of very sharply outlined, imbricated feathers, the more posterior of which are considerably elongated, forming a pointed crest in the latter and a rounded one in the former, which in addition possesses a brilliantly metallic gorget of imbricated or scale-like feathers, the throat of *Bellona* being clothed

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* Metallic throat-spots which do not cover the whole throat are not counted as gorgets in this estimate.

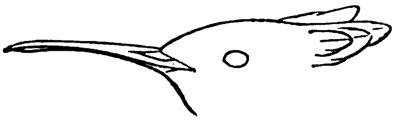

FIG. 41.—Double crest of *Aithurus polytmus*.

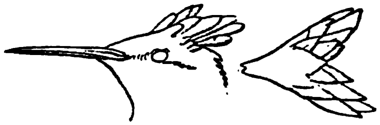

FIG. 42.—Double crest of *Heliactin cornuta*.

with a blended and somber colored plumage. In *Bellona* the crest is glittering green, sometimes passing into blue at the tip, or even for the terminal half; in *Chrysolampis* the crest is ruby-red, the throat golden-orange or topaz.

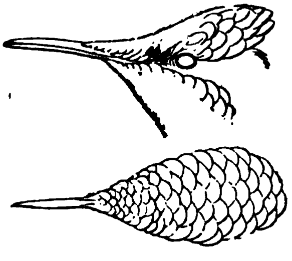

FIG. 43.—Vertical view of crest of *Chrysolampis moschitus*, ♂.

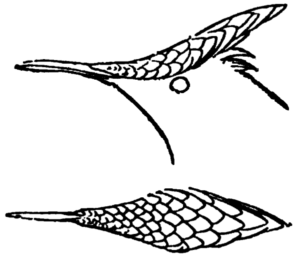

FIG. 44.—Vertical view of crest of *Bellona cristata*, ♂.

The genus *Cephallepis* has a much lengthened, narrow, pointed, and slightly recurved crest, closely resembling that of the Lapwing Plover (*Vanellus vanellus*). That of *Oxypogon* (see Fig. 38, p. 303) is somewhat similar. All of the species of the genus *Lophornis*, embracing the ex-

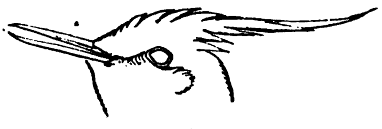

FIG. 45.—*Cephallepis delalandi*, ♂.

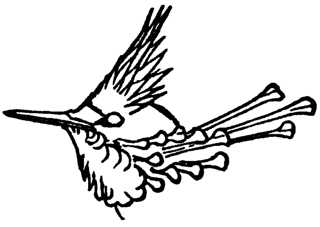

FIG. 46.—*Lophornis ornatus*, ♂.

quisitely ornamented, bespangled, frilled, and otherwise decorated "Coquette" Humming Birds possess crests in addition to their other ornaments, which vary in their character with the species; but here the subject becomes so intricate that to pursue it further would require far more space than can here be afforded, besides perhaps proving tiresome to the reader. The subject should not be dismissed, however, without calling attention to a very elegant adornment of several genera in the shape of "muffs" or "puffs" of the most delicate possible cottony down clothing the legs and almost hiding the dainty feet. These puffs are usually white, but sometimes brown, or more rarely black, and are most conspicuously developed in the genera *Panoplites*, *Eriocnemis*, and *Steganura*.

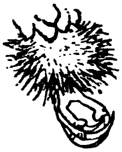

FIG. 30.—Leg-puffs of *Panoplites flavescens.*

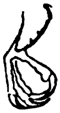

FIG. 31.—Short tarsal feathers of *Heliodoxa jacula.*

## COLORS OF THE PLUMAGE.

When morning dawns, * * * * *
The flower-fed Humming Bird his round pursues;
Sips with inserted tube the honied blooms,
And chirps his gratitude as round he roams;
While richest roses, though in crimson drest,
Shrink from the splendor of his gorgeous breast.
What heavenly tints in mingling radiance fly!
Each rapid movement gives a different dye;
Like scales of burnished gold they dazzling show—
Now sink to shade, now like a furnace glow!
—ALEXANDER WILSON.

While their diminutive size is one of the most striking peculiarities of Humming Birds, their beautifully varied or resplendently metallic plumage is, as a rule, not less so.

Reference has been made on previous pages to the luminous gorget of many species, and to the shining crests or beards of others; but we failed to mention that some kinds, instead of having luminous throats, have the halo of radiance transferred to their crowns, as in species of *Uranomitra*, in which the color is blue or violet, and *Eustephanus*, in which it is brilliant red or green, according to the species. Frequently there is a spot of the most brilliant emerald-green on the forehead, immediately above the base of the bill, forming "a star brighter than Venus, the queen of planets" (Gould). It is worthy of remark that this glittering gem-like spot has always a setting of the most intense velvety black, to increase, by contrast, its brilliancy. Usually, but not always, these same Humming Birds have a similar spot on the middle of the throat, its color, however, more often violet than green; and occasionally there are two brilliant spots on the throat, one below the other, and of a different color, in which case it is interesting to observe, that only one of them reflects its full brilliance at once, it being necessary for the bird (or the person holding it, if a stuffed specimen), to shift its position slightly to bring the other into full view—which, however, is done at the expense of the one previously seen.

In some kinds the area of brilliant coloration lies upon some other part of the bird than the head or throat. In some species of the genus *Eriocnemis*, the amply developed upper tail-coverts are most glitteringly brilliant, while in another genus, *Aglœactis*, the whole rump is metallic, all the rest of the plumage being devoid of luster.

With the exception of the genus last mentioned, Humming Birds show the full brilliancy of their metallic colors only when the plumage is viewed toward the direction in which the feathers lie;* that is, one having a specimen in his hand, must, in order to obtain the richest effect, hold it with the head towards him, the bird itself on the opposite side from which the light comes. Reversing its position relative to himself (but not to the light), the metallic hues disappear or are but faintly discernible. In *Aglœactis*, however, exactly the reverse is the case, the burnished metallic hues of the rump appearing only when viewed *against the ends* of the feathers.†

In more than 99 per cent. of the species of Humming Birds, the color of the primaries is a dull purplish dusky, with very faint metallic luster. So nearly universally, in fact, is this the case, that there appear to be only two conspicuous exceptions, the Sapphire-wing (*Pterophanes temmincki*)—next to *Patagona gigas*, the largest of Humming Birds—in which all the remiges are a brilliant steel-blue, or in a strong light almost a Prussian-blue color, and the Purple Carib (*Eulampis jugularis*), in which their color is lustrous bluish green. In no species of Humming Bird are the primaries parti colored; and when, as is sometimes the case, the secondaries are of more than one color, the additional color is invariably rufous.

On the other hand, brilliantly colored tails are very common, and sometimes the gorgeous coloring of this member is unapproached by that of any other birds. The Comet Humming Birds (genus *Sappho*), for example, have very long and deeply forked tails (see Pl. XXI, Fig. 4), of the most glittering brilliant metallic red, each feather tipped with velvety black. The allied genus *Cyanolesbia* has a tail of similar size and shape (Pl. XXII, Fig. 4), but burnished metallic blue or green, instead of red. The genera *Augastes*, *Chrysuronia*, *Metallura*, and *Avocettula* have the brilliant coloration of the tail most conspicuous on the under surface, which is of a splendid golden bronze or red bronze, according to the species. There are also other types of coloration affecting the rectrices, but they are too numerous to particularize in this connection.

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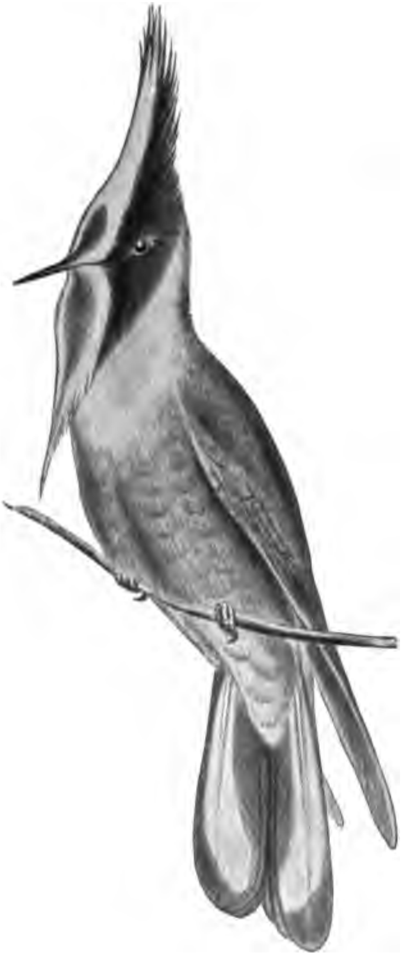
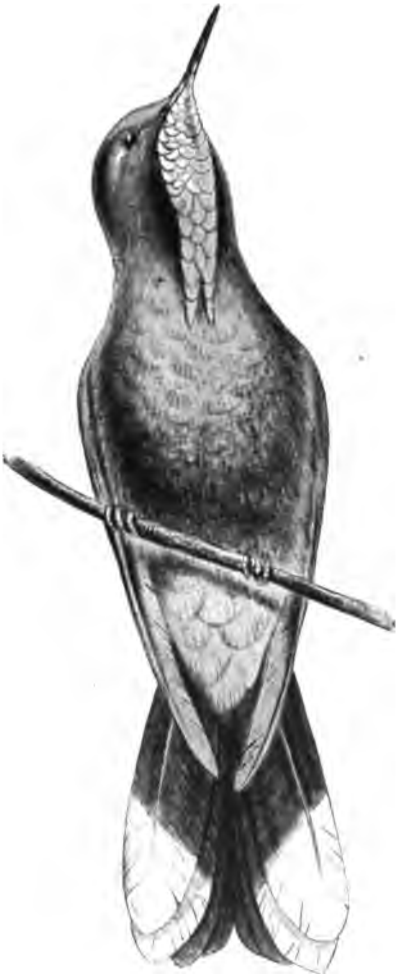
*"In such Humming Birds as I have examined," says Gosse (*Birds of Jamaica*, pp. 94, 95), "the iridescence of those portions of the plumage that are changeable, is splendid in the ratio of the acuteness of the angle formed by the incident ray and the reflected one. Thus the plumes of the neck of the Man go appear to advantage in a room with a single light, only when the beholder stands with his back to the window, and has the bird before him and facing him. Then the perpendicular band down the throat and breast, which seems composed of the richest black velvet, is bounded on each side by a broad band of glowing crimson, mingled with violet."

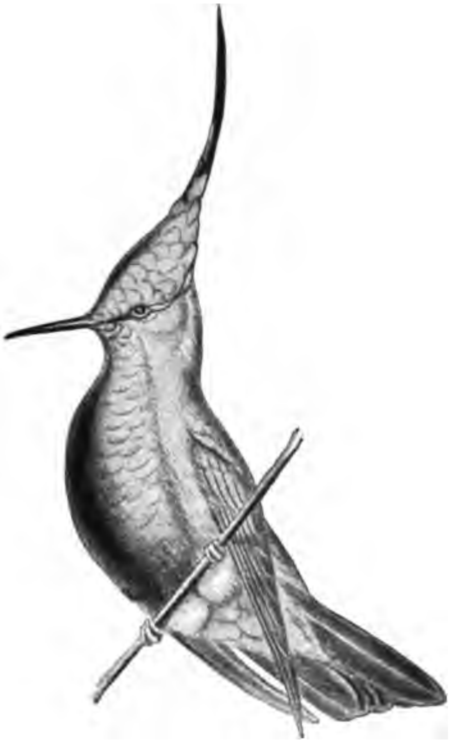
†The same thing, though to a less degree, is observable in the species of *Lampropygia*, in which, however, the metallic coloring of the rump is much less brilliant.



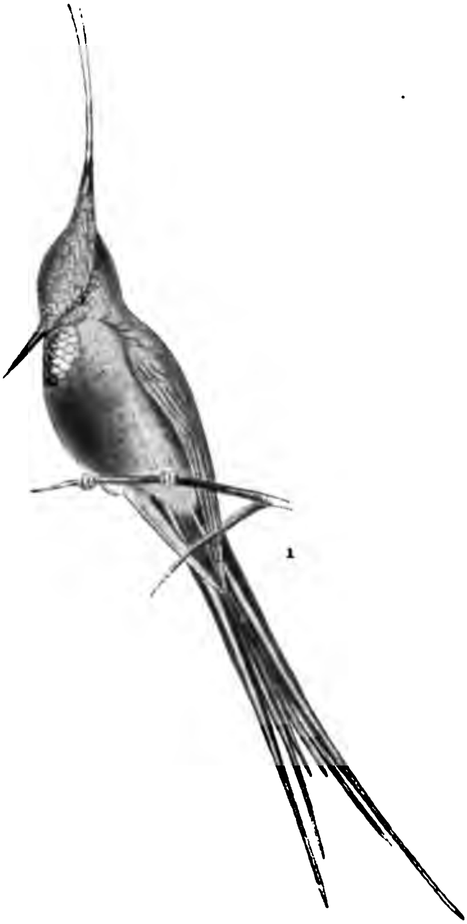
GUERIN'S HELMET-CREST (*Oxypogon guerini*). (After Gould.)



HERRAN'S THORN-BILL (*Ramphomicron herrani*). (After Gould.)



**De Laland's Plover-crest** (*Cephallepis delalandi*). (After Gould.)



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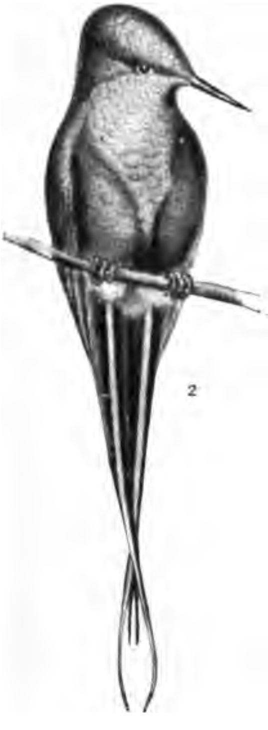

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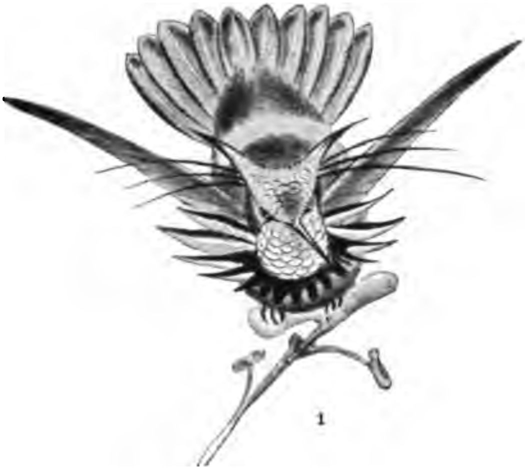
**Fig. 1.** Popelaire's Thorn-tail (*Popelairia popelairia*). (After Gould.)
**Fig. 2.** Convers' Thorn-tail (*Popelairia conversi*). (After Gould.)



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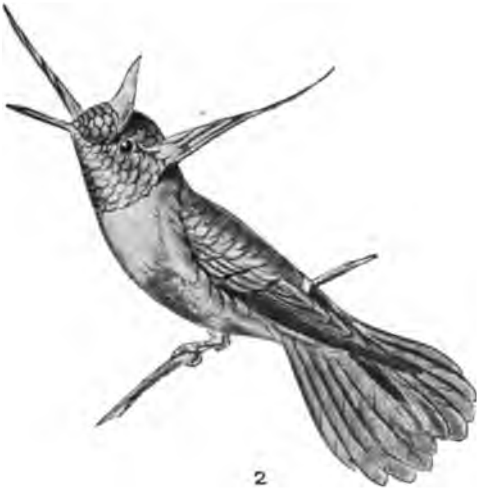

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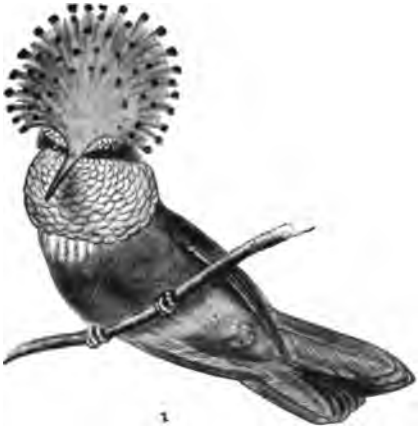
Fig. 1. Princess Helena's Coquette (*Lophornis helenæ*). (After Gould.)
Fig. 2. Adorable Coquette (*Lophornis adorabilis*). (After Mulsant and Verreaux.)



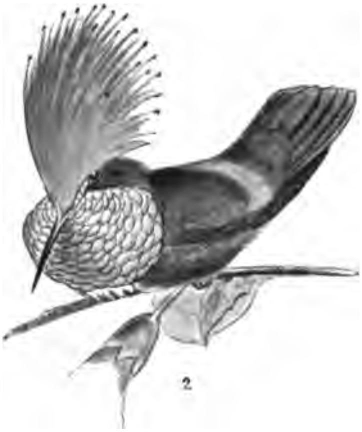
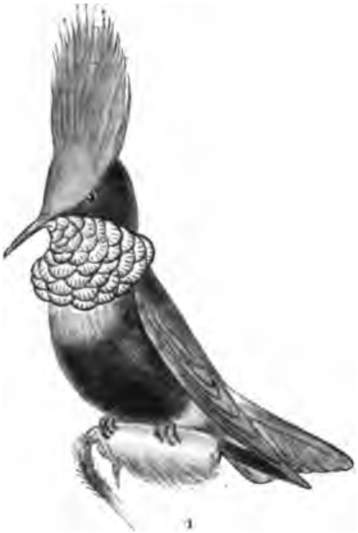


Fig. 1. **Spangled Coquette** (*Lophornis reginæ*). (After Gould.)
Fig. 2. **Great-crested Coquette** (*Lophornis regulus*). (After Gould.)



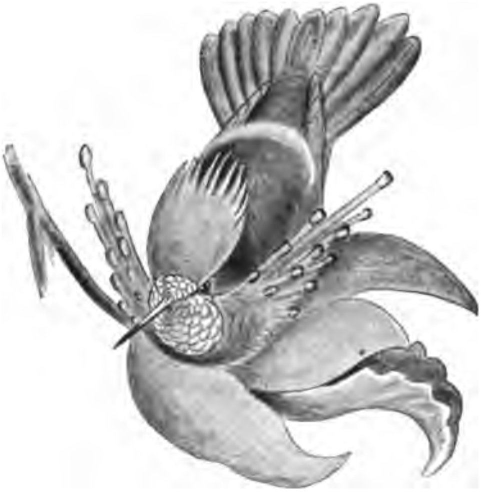
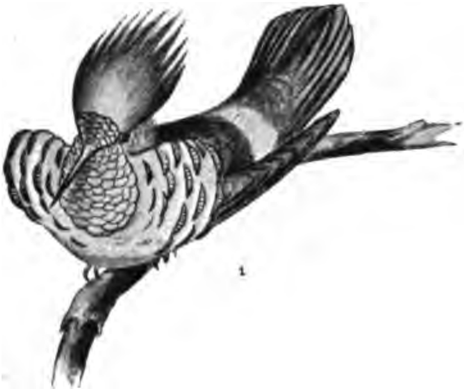


Fig. 1. DE LATTRE'S COQUETTE (*Lophornis delatrii*). (After Gould.)
Fig. 2. TUFTED COQUETTE (*Lophornis ornatus*). (After Gould.)



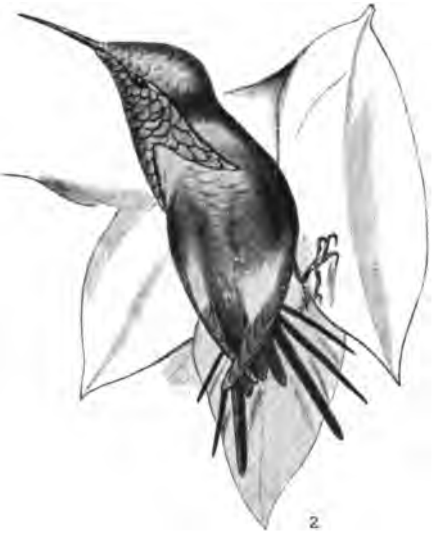
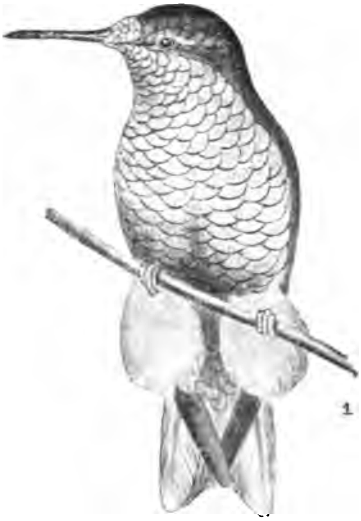


Fig. 1. Frilled Coquette (*Lophornis magnificus*). (After Gould.)
Fig. 2. Heliodore's Wood-star (*Acestrura heliodori*). (After Gould.)



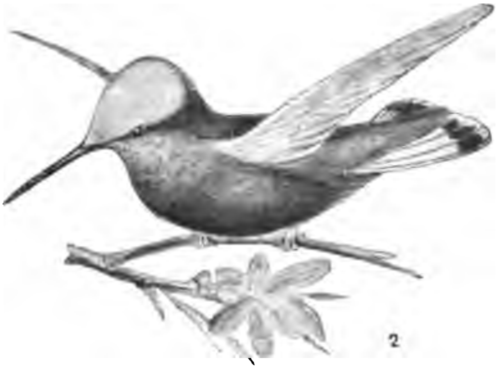


Fig. 1. ALINE'S PUFF-LEG (*Eriocnemis alinæ*). (After Gould.)
Fig. 2. SNOW-CAP (*Microchera albocoronata*). (After Gould.)

### CAUSE OF THE CHANGEABLE HUES OF HUMMING BIRDS.

Many persons may naturally wish to know the cause or causes of this brilliant metallic coloration of Humming Birds. This is a subject which has been investigated by physiologists, who have found that in most cases it depends on the *structure* of the feathers, and not on the presence of coloring matter or pigment.

A few days since [says Mr. Martin] we were examining a Humming Bird, the gorget of which was an intense emerald-green; but on changing the light (that is, altering its angle of incidence), the emerald was changed to velvet-black. Audebert considered this changeableness to be due to the organization of the feathers, and to the manner in which the luminous rays are reflected on falling upon them; and of this we think there can be little doubt, for each feather, when minutely inspected, exhibits myriads of little facets so disposed as to present so many angles to the incidence of light, which will be diversely reflected according to the position of the feather, and in some positions not reflected in any sensible degree, and thus emerald may become a velvet-black. Lesson supposes that the brilliant hues of the plumage of the Humming Birds are derived from some elements contained in the blood, and elaborated by the circulation—a theory we do not quite understand, inasmuch as color is the result of the reflection of some rays and the absorption of others, caused by the arrangement of the molecules of any given body. He adds, however, that the texture of the plumes plays the principal part, in consequence of the manner in which the rays of light traverse them or are reflected by the innumerable facets which a prodigious quantity of barbules or fibers present. All the scaly feathers, he observes, which simulate velvet, the emerald, or the ruby, and which we see on the head and throats of the *Epimachi* (as the Grand Promerops of New Guinea), the Paradise Birds and the Humming Birds resemble each other in the uniformity of their formation; all are composed of cylindrical barbules, bordered with other analogous regular barbules, which in their turn support other small ones; and all of them are hollowed in the center with a deep furrow, so that when the light, as Audebert first remarked, glides in a vertical direction over the scaly feathers, the result is that all the luminous rays are absorbed in traversing them, and the perception of black is produced. But it is no longer the same when the light is reflected from these feathers, each of which performs the office of reflector; then it is that the aspect of the emerald, the ruby, etc., varying with the utmost diversity under the incidences of the rays which strike them, is given out by the molecular arrangement of the barbules. It is thus that the gorget of many species takes all the hues of green, and then the brightest and most uniformly golden tints, down to intense velvet-black, or on the contrary that of ruby, which darts forth pencils of light, or passes from reddish orange to a crimsoned red-black. It is thus we think that the everchanging hues of the gorgets of the Humming Birds from black to emerald, ruby, crimson, or flame color are to be explained.

Brilliant, however, as are the hues reflected from the stuffed Humming Bird, the perfection of their changeable radiance or refulgence can be fully realized only in the living bird.

Bullock, when speaking of the same subject, says that "the preserved specimens were but the shadow in brilliancy to what they were in life. The reason is obvious; for the sides of the laminæ or fibers of each feather being of a different color from the surface will change when seen in a front or oblique direction; and as each lamina or fiber turns upon the axis of the quill the least motion, when living, causes the feathers to change suddenly to the most opposite hues."

## BRIEF DESCRIPTIONS OF SOME OF THE MORE BRILLIANTLY COLORED KINDS.

Among the half-thousand species of Humming Birds, the diversity of plumage as well as form is very great. It will not be practicable, therefore, to do more in the way of describing particular kinds than to select those which are most conspicuous in this respect. Before proceeding to do so, it may be well to explain that in a large majority of cases ornamentation is confined to the males alone, the females being as a rule devoid of the refulgent hues and ornamental plumes, and therefore much more like one another than those of the opposite sex. Occasionally, however, as in the genera *Petasophora*, *Eupetomena*, *Panoplites*, *Aglæactis*, *Lampropygia*, and a few others, the sexes are alike in color, or at least not essentially different. In only one species, the Mango Humming Bird (*Lampornis mango*), of Jamaica, is the female more beautiful than the male, having, in addition to the colors possessed by the latter, a brightly colored throat-patch. As a rather remarkable coincidence, it may be mentioned that the largest and smallest species of the family, *Patagona gigas* and *Mellisuga minima*, are among the most plainly colored of all, with little difference between the sexes.

Perhaps the most remarkable of Humming Birds, though more distinguished for the extraordinary development of its tail feathers than for brilliancy of plumage, is the Marvellous Humming Bird (*Loddigesia mirabilis*), of Peru. An idea of the form of the tail in this elegant bird may be obtained from the outline figures on Plate XXIII. Its coloration while not conspicuous for brilliancy in such a brilliant coterie, is nevertheless very pretty: Crown azure-blue, back golden green, tail violet-black, and lower parts pure white, with a gorget of emerald-green bordered on each side by a line of coppery red.

The Topaz-throated or King Humming Birds (genus *Topaza*) are among the largest of the family and are further conspicuous for their elegant form and brilliant plumage. There are two species, the Crimson Topaz (*T. pella*), of Guiana and the Lower Amazons, and the Fiery Topaz (*T. pyra*) of the northern tributaries of the great South American river. The former is much the better known and is a truly magnificent bird, some 8½ inches in total length, although some 3 inches of this are taken up by the lengthened caliper-like tips of the second pair of tail feathers. The general color is a brilliant metallic crimson, the whole throat of the most glittering, burnished golden-yellow or topaz, changing to emerald-green, encircled by velvety black, which covers also the sides and top of the head.

The Fire-tailed or Comet Humming Birds (genus *Sappho*) also include two species, belonging to Peru, Bolivia, and the Argentine Republic. "The tails of the males blaze with the radiance of flashes of flame, and their ruby backs, luminous green throats, and under surface present a *tout ensemble* unparalleled in the range of ornithology,"* while Mr.

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* D. G. Elliot, in Standard Natural History, Birds, p. 446.

Gould says that the two species generally known under the names of *Sappho** and *Phaon*† are *par excellence* the most gorgeous of birds in existence, so far as regards the coloring of their tails; and well do these living meteors deserve the more general name of *Comets*." The tail of these birds is greatly lengthened, and, when spread is forked, as shown in Fig. 4, Pl. XXI. The upper surface of these feathers is burnished to a degree scarcely to be equaled by any art, and glows with a refulgence not surpassed by any gem, the glorious color heightened by contrast with the bold and sharply defined velvety black tip to each feather. In the Sappho Comet (*S. sparganura*) the red color of the tail and rump is of an orange-red or scarlet hue, while in the Phaon Comet (*S. phaon*) the color is the loveliest crimson or purple-red.

Allied to the Comet Hummers are the Sylph Humming Birds (genus *Cyanolesbia*), the tails of which are of similar form, but gloriously blue and green, shaded with violet, in one species, splendid green in another, and with black centers instead of tips. (See Pl. XXII, Fig. 4.) They inhabit the mountains of northern and western South America.

So far as the coloration of the head alone is concerned, no other Humming Bird equals the Ruby and Topaz (*Chrysolampis moschitus*). "It is a species," says Mr. Gould, "which plays no inconsiderable part as an article ot trade; for it is the one *par excellence* of which thousands are annually sent to Europe for the purpose of contributing to the decorations of the drawing-rooms of the wealthy, for the manufacture of artificial flowers, etc.; and well suited is it for such purposes, its rich ruby and topazlike coloring rendering it one of the most conspicuous and beautiful objects imaginable.

One of the most beautiful of Mexican Humming Birds is De Rham's Garnet (*Lamprolaima rhami*). It is a large species, some 4½ inches long; green above; throat, metallic solferino or garnet; breast, rich metallic violet blue, the tail, which is very broad and slightly forked, being of a violet-black hue.

Scarcely less beautiful and considerably exceeding it in size is De Lattre's Sabre-wing (*Campylopterus hemileucurus*), a species which extends from northern Mexico nearly to the Isthmus of Panama. It is of a uniform rich metallic violet-blue color; rump, green; and the tail, white and black in nearly equal proportion. The remarkable structure of the wing of this species, which is about the same as in the genus *Sphenoproctus*, is shown in Fig. 22, on page 299, which represents that of *S. pampa*. A South American congener of this species is the Splendid Sabre-wing (*C. villavicencio*), which has the crown glittering golden-green changing to coppery-red; the throat and breast, glittering blue; and the other portions chiefly dark green.

Undoubtedly the most brilliant of Central American Humming Birds is that curiously local species which is confined to the higher slopes of a few of the volcanic peaks in Costa Rica and Veragua, and is known as the Irazú Humming Bird (*Panterpe insignis*). In this the crown is rich metallic blue; the upper parts bronzy green, changing to blue on the upper tail coverts; the breast is also blue, but the whole chest and throat are of the most glowing hues, commencing with golden green exteriorly and passing through golden yellow into orange and finally culminating in scarlet in the center.

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* *Sappho sparganura* (Shaw).

† *Sappho phaon* (Gould).

The Puff-legs (genus *Eriocnemis*) are beautiful Humming Birds of medium size, which have the legs clothed with the daintiest muffs or puffs imaginable of cottony or downy feathers, white, buff, brown, or black, according to the species. Perhaps the finest of them is the Glowing Puff-leg (*E. vestita*), whose upper tail coverts are of a dazzling brilliancy unsurpassed and seldom, if ever, equaled by any other object in nature. Mr. John Gould, the celebrated author of that most magnificent of all bird books, the Monograph of the Trochilidæ, says:

> Everyone who, for the first time, finds himself in front of the compartment of my collection in which this species is placed, gives utterance to some exclamation expressive of the admiration excited by its striking beauty and glowworm-like splendor of its upper tail coverts. This brilliancy is more apparent at certain hours of the day; for instance, it is more beautiful in the evening after sunset than at midday, the brilliancy being relieved by the dark hue of the tail feathers. It is unquestionably one of the finest species of the genus, and one of the most resplendent of the *Trochilidæ;* would that it were possible for me to even faintly depict it! But no, the most finished drawing can be but a phantom of the original, and it is only by an examination of the specimen that my readers can form any adequate idea of the splendor and beauty of this gem; and how much more gorgeous must the bird appear in its native wilds.

These are the mountain valleys of Colombia.

Even more beautiful, in the writer's opinion, is a gloriously-colored Humming Bird found in eastern Ecuador, the *Panoplites jardinii;* for, while the gorgeous coloring of the Glowing Puff-leg is mainly confined to a limited area, that of Jardine's Humming Bird embraces its entire body. The crown and lower parts are richest metallic violet-blue; the sides of the breast, the back, and the rump, bluish emerald-green; and the wing coverts golden green. It is the excessive refulgence of the two shades of green, however, which gives the plumage of this bird such a splendid brilliancy, for, in certain lights, they glow with more than metallic clearness, while the deep, velvety black of the nape and the snowy white of the tail feathers heightens the effect by their striking contrast. "The accompanying plate," says Mr. Gould, "is intended to represent one of the most beautiful of the *Trochilidæ* yet discovered. I say intended, for whatever success may have attended my attempts to convey an idea of the beauty of these living gems, I must confess that the means at my command are utterly inadequate to do justice to the present species, whose crown, back, shoulders, and chest sides are clothed with hues of metallic blue and green of such resplendant brilliancy that it is quite impossible to represent them on paper."

Of the West Indian Humming Birds the most exquisite is Princess Helena's Hummer (*Calypte helenæ*), of Cuba. This is perhaps the very smallest of birds, being even less than the *Mellisuga minima*, of Jamaica and Haiti, which has hitherto enjoyed the distinction of being considered the smallest of existing birds. Princess Helena's Humming Bird is rich metallic blue above (a very unusual color in this family), and white beneath, the entire head, including the gorget with its ruff-like lateral projections, being the most beautiful metallic rose-red or crimson.

A much larger species belonging to the Lesser Antilles, the Purple Carib (*Eulampis jugularis*), however, contests the claim of the little Cuban gem to be considered the most richly colored of Antillean Hummers. The Purple Carib has the upper parts velvety black, except the wings and upper tail-coverts, which are of a burnished bluish green hue, while the throat and breast are of a rich garnet-purple.

The most remarkable, however, of West Indian Humming Birds is the Long-tailed Hummer (*Aithuras polytmus*), which Mr. Gosse styles "the gem of Jamaican Ornithology," adding that "its slender form, velvet crest, emerald bosom, and lengthened tail plumes render it one of the most elegant even of this most brilliant family."

A truly noble Humming Bird is the Mountain Nymph (*Oreonympha nobilis*), of the Peruvian highlands, a bird approaching the Giant Hummer (*Patagona gigas*) in size, but otherwise not to be compared with that somberly clad species. The Mountain Nymph is about 7 inches in length, of which about half is taken by the deeply forked but broad-feathered tail. The forehead and side of the head are black, the rest of the head dark blue; the throat is metallic emerald green, the lower portion ornamented by a beard-like tuft of lengthened feathers of a rich metallic reddish purple. The upper parts of the body are bronzy, the lower parts white.

The most elaborately decorated Humming Birds belong to the group known as Coquettes (genera *Lophornis* and *Polemistria*), on account of their frilled, ruffled, and bespangled plumage, their ornamentations being confined to the head or neck. There are about ten species (of which all but three occur only south of the Isthmus of Panama), the most beautiful of which is perhaps the Frilled Coquette (*L. magnificus*) of Brazil. In this there is a fan-like ruff or frill on each side of the neck, of snowy white, but each feather tipped with a crescent-shaped bar of glitering green; the crest, of pointed feathers, is rich chestnut or rufous, while the throat and forehead are emerald green.

Hardly so beautiful but more curiously adorned is Princess Helena's Coquette (*L. helenæ*), of Mexico and Central America. In this the lapwing-like crest is dark green, the throat glittering green set in a black border; from each side of the occiput spring three long hair-like black plumes, while on each side of the neck is a tuft or ruff of black feathers streaked with buff.

The Adorable Coquette (*L. adorabilis*) inhabits parts of Costa Rica and Veragua. It has the forehead dull ruby red or copper color; the very pointed crest snow white, and a tuft of pointed feathers on each side of the head greenish black.

The Spangled Coquette (*L. stictolophus*) has a very conspicuous, almost fan-shaped crest of a bright rufous color, dotted or spangled with emerald green.

The Frilled Coquette (*L. ornatus*) has the forehead and throat rich metallic green; the crest of pointed feathers, chestnut; from each side of the neck project lengthened narrow feathers of a rufous color, each with an expanded tip of metallic green.

The Coquette Humming Birds are all of small size, most of them less than 3 inches long, and none of them much over that length, and, together with the genera *Popelairia* and *Discura*, constitute a strongly marked group or section of the family, strikingly characterized by the presence, in both sexes, of a distinct band of white or buff across the rump, a feature wanting in all other genera.

The Sun-gem (*Heliactin cornuta*), of Brazil, is one of the most curious as well as beautiful of Humming Birds, and is furthermore unique in both form and plumage. The tail is long and wedge shaped, and the head is ornamented by a flattened tuft of broad imbricated feathers springing from each side of the occiput, the color of these tufts being a glowing metallic scarlet, passing into golden yellow at the tips. The forehead and crown are shining greenish blue, the throat velvety black, the rest of the under parts mostly white, and the upper parts bronzy green,—certainly not a very extraordinary coloration for a Humming Bird; but, in the flattened head-tufts mentioned, there seems to be concentrated enough splendor of color to make up for the absence of brilliancy from the rest of the plumage, and quite justifying the name which has been given the bird.

In the mountains of Veragua and Costa Rica dwell two little Humming Birds called "Snow-caps" (genus *Microchera*), which are altogether unlike any others in their coloration. The whole top of the head is snow white, while the rest of the plumage is rich plum purple (in *M. parvirostris*) or blue-black (*M. albocoronata*). This coloration is remarkable for its chaste simplicity, and the little creatures which wear it, hardly half as big as our Ruby-throat (*Trochilus colubris*), are certainly unique in their dainty loveliness.

## HUMMING BIRDS OF THE UNITED STATES.

Within the borders of the United States only seventeen species of Humming Birds have been found, and of this number only seven can be considered as properly belonging to our country, their breeding range being chiefly or entirely within our limits. These are the Ruby-throated Humming Bird (*Trochilus colubris*), Black-chinned Humming Bird (*T. alexandri*), Anna Humming Bird (*Calypte anna*), Broad-tailed Humming Bird (*Selasphorus platycercus*), Rufous Humming Bird (*S.

*rufus*), Allen's Humming Bird (*S. alleni*), and Calliope Humming Bird (*Stellula calliope*). Of the remainder six are Mexican species, barely crossing our border, as follows: Rivoli Humming Bird (*Eugenes fulgens*), Blue-throated Humming Bird (*Cœligena clemenciæ*), Lucifer Humming Bird (*Calothorax lucifer*), Rieffer's Humming Bird (*Amazilia fuscicaudata*),* Buff-bellied Humming Bird (*A. cerviniventris*), and Circe Humming Bird (*Iache latirostris*). One species, Costa's Humming Bird (*Calypte costæ*), is common to southern California, Lower California, and western Mexico; another, Xantus's Humming Bird (*Basilinna xantusi*), is peculiar to Lower California, and therefore not belonging to the United States as politically bounded. The two remaining species are of uncertain range, one of them, the Violet-throated Humming Bird (*Trochilus violajugulum*), being known from a single specimen obtained in southern California, and the other, Floresi's Humming Bird (*Selasphorus floresii*), having been obtained at two widely separated points, Bolanos, Mexico, and San Francisco, California, and only one specimen at each place. The species first mentioned above is the only one that belongs to the extensive region east of the Rocky Mountains, even semi-tropical Florida having hitherto failed to produce a single additional species, even as a straggler or accidental wanderer from more southern lands. It is true that Mr. Audubon described and figured in his great work a species which he called the Mango Humming Bird (*Trochilus mango*), from a specimen given him by Dr. Bachman, said to have been captured at Key West, Florida; but the species† proves to be not even a West Indian one, but belongs to Brazil and other parts of South America, and possibly was not found at Key West, as alleged. Another South American Hummer, the Tobago Humming Bird (*Agyrtria tobaci*) has been recorded as North American on the strength of the alleged capture of a specimen at Cambridge, Massachusetts; but, while the identification is correct, there is circumstantial evidence that the specimen was accidentally or carelessly substituted for an example of the common Ruby-throat in the shop of the taxdermist who mounted it.

Of the seventeen kinds of Humming Birds which occur within the limits of the United States decidedly the finest species is that known as the Rivoli Humming Bird (*Eugenes fulgens*), a bird of the Mexican table-lands, but occurring also in southern Arizona. This fine hummer is nearly 6 inches in length, being with one exception‡ much the largest in our list. The male has the top of the head rich metallic violet, the throat brilliant emerald-green, contrasted very abruptly with the deep black of the breast, while the upper parts are dark bronzy green. These various hues are so arranged or contrasted that only one of them can be seen at once, every change in the bird's position bringing a different color into view. The most brilliantly colored of our Humming Birds are species of the genera *Calypte* and *Selasphorus*, the former having two and the latter four species within our limits, all of them belonging to the western portion of the country.

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*This species occurs throughout Central America, from northeastern Mexico southward, and also in northwestern South America as far as Ecuador.

†The specimen in question is now in the National Museum collection, having been given to Professor Baird by Mr. Audubon. It is not an example of the true Mango Humming Bird (*Lampornis mango*), which is a Jamaican species, but belongs to the species known as *L. violicauda* (Bodd.).

‡The Blue-throated Humming Bird (*Cœligena clemenciæ*), inhabiting the same region, is about the same size.

The males of the species of *Calypte* have the whole top of the head of the same brilliantly metallic hue as the gorget, in which respect they differ from all other of our hummers excepting the *Selasphorus floresii*, which is possibly a hybrid between *Calypte anna* and *Selasphorus rufus* or *S. alleni*. In Anna's Humming Bird (*C. anna*) the crown and gorget are of a richly burnished crimson, changing to purple or even bluish in certain lights. Costa's Humming Bird (*C. costæ*) is a much smaller species, and has the lateral feathers of the gorget much elongated, the gorget and crown being of the richest violet, changing to purple, blue, and even green.

The Rufous Humming Bird (*Selasphorus rufus*) and Allen's Humming Bird (*S. alleni*) have the gorget of a surpassingly vivid fiery red or metallic scarlet, changing to crimson, golden, and even brassy-green, according to the direction of the light, or glowing like a live coal when viewed from a certain direction. So far as lumage is concerned these two species are very much alike, but *S. rufus* has the upper parts deep rufous or brick-color, tinged with green on the back, whereas *S. alleni* is almost entirely green above. The Broad-tailed Humming Bird (*S. platycercus*) is larger than either of the preceding species, and has the gorget soft solferino-pink, with its lateral feathers not elongated—those of the other two being conspicuously lengthened, as in the species of *Calypte*. The remaining North American species of *Selasphorus*, Floresi's Humming Bird, has not only the gorget, with its elongated lateral feathers, vivid metallic scarlet, but the whole top of the head also; otherwise, it resembles most in color the *S. alleni*. It is one of the rarest of humming birds, only two examples having been met with, one of them near Bolanos, in Mexico, the other near San Francisco, California.

The Lucifer Humming Bird (*Calothorax lucifer*) has the deeply-forked gorget of a vivid violet-purple, changing to reddish-purple or blue, according to the light. It is the only one of our North American species having a curved bill.

The Calliope Humming Bird (*Stellula calliope*) differs from all others in having the feathers of the ruff narrowed and strongly individualized, each being snow-white for the basal portion and metallic purple at the tip.

The three species of the genus *Trochilus* differ conspicuously from one another in the color of the gorget. In the Ruby-throat (*T. colubris*) its color is, as the name indicates, a glowing ruby-red. In the Black-chinned Humming Bird (*T. alexandri*) it is velvet-black for the upper half and metallic violet, changing to blue, on the lower. In the Violet-throated Humming Bird (*T. violajugulum*), a species so rare that but a single specimen has been obtained, it is lilac-purple.

We have now exhausted the list of North American Humming Birds, the males of which are adorned with true gorgets, and have come to a small group of species which are not only characterized by the absence of this ornament (though the throat is brilliantly colored in them all) but also by the form of the bill, which is much broader, with the nasal valves wholly unfeathered and somewhat swollen, the color of the bill, in life, being reddish (sometimes deep red) with a dusky tip, whereas in all the other North American hummers the bill is entirely or mainly black. Of this group there are three species known to cross the Mexican boundary into the southern parts of Texas and Arizona, while another is peculiar to Lower California. The latter is Xantus's Humming Bird (*Basilinna xantusi*), the only known congener of which is the White-eared Humming Bird (*B. leucotis*) of the Mexican highlands. The male of Xantus's Humming Bird has the forehead dark blue, the chin and a broad stripe beneath the eye velvety black, the throat and chest brilliant emerald-green, and the tail chestnut. Behind the eye is a broad white streak. Its Mexican relative is very similar, but differs in the color of the tail, which is blackish with the middle feathers greenish bronze, and in the forehead being much brighter blue.

The Circe Humming Bird (*Iache latirostris*) belongs to western Mexico, but occurs just beyond the border in Arizona. The male is bronzy green above, the under parts brilliant green, changing to sapphire-blue on the throat, the under-tail coverts white.

The remaining two species occur in the lower Rio Grande Valley of Texas and belong to the genus *Amazilia*. They agree in being bronzy green above, the tail rufous or chestnut (with feathers margined at tips with bronzy), and in being brilliant green below, changing to brownish or buffy posteriorly. Reiffer's Humming Bird (*A. fuscicaudata*) has the belly and flanks brownish gray, under tail coverts deep cinnamon, and upper tail coverts chestnut. The Buff-bellied Humming Bird (*A. cerviniventris*) differs in having the belly, flanks, and under tail coverts pale cinnamon or buff, and the upper tail coverts chiefly green or bronzy.

The following "key" is intended to facilitate the identification of genera merely, and excludes very numerous forms not found within the geographical limits indicated above, though those of contiguous territory are included. The "key" is essentially the same as that on pages 303 to 309 of the author's "Manual of North American Birds" * modified, however, to better adapt it to the present work.

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* A Manual of North American Birds, by Robert Ridgway. Illustrated by 464 outline drawings of the generic characters. Philadelphia: J. B. Lippincott Company, 1887. Royal octavo, pp. i–xi, 1–631, pll. i–cxxiv. Frontispiece (portrait of Prof. Spencer F. Baird), and memorial leaf.

## *KEY TO THE GENERA OF HUMMING BIRDS OCCURRING IN THE UNITED STATES, MEXICO, CUBA, AND THE BAHAMAS.*

$a^1$. Anterior toes united for basal half; bill much compressed (except at base), about two-thirds as long as wing, decidedly arched; tail graduated, the middle pair of feathers much longer than the others, all tipped with white or buff; plumage very dull, almost devoid of metallic colors. (Subfamily *Phaëthornithinæ*).. *Phaëthornis.**

$a^2$. Anterior toes all cleft to the base; bill never much compressed (usually broader than deep), less than two-thirds as long as the wing (except in *Calothorax* and some species of *Doricha*), usually nearly straight (distinctly curved only in *Campylopterus*, *Lampornis*, *Calothorax*, and some species of *Doricha*); tail variable in form, but if graduated the middle pair of feathers neither elongated nor white tipped. (Subfamily *Trochilinæ.*)

  $b^1$. Inner webs of two outer tail-feathers white, except at end ........ *Eupherusa.*†

  $b^2$. Inner webs of two outer tail-feathers without white, except sometimes at tip.

    $c^1$. Exposed culmen not more than 45; tail even, two-thirds as long as wing, the latter 1.75–2.00 ........................................ *Abeillia.*‡

    $c^2$. Exposed culmen decidedly more than .45.

      $d^1$. Tail nearly as long as wing, wedge-shaped, with feathers broad and rounded at tips; shafts of three outer quills much (sometimes enormously) thickened; wing about 2.60 .............................. *Sphenoproctus.*§

      $d^2$. Tail much shorter than wing; if wedge-shaped, the feathers narrow and pointed at ends.

        $e^1$. Exposed culmen less than one-fourth as long as wing; quills and secondaries rufous, with darker tips or terminal margins ...... *Lamprolaima.*‖

        $e^2$. Exposed culmen more than one-fourth as long as wing.

          $f^1$. Exposed culmen one-half as long as wing, or longer.

            $g^1$. Wing 2.20 or more; tail rounded, the feathers broad; bill long, stout, and straight, nearly as long as tail; outer tail-feathers tipped with white in both sexes .............................. *Floricola.*¶

            $g^2$. Wing less than 2.00 (1.30–1.70); tail forked in males, double-rounded in females; bill slender, curved (except in two or three species of *Doricha*); outer tail-feathers tipped with white only in females.

              $h^1$. Tail shorter than wing or exposed culmen, the feathers pointed in adult males ........................................ *Calothorax.* (P. 358.)

              $h^2$. Tail longer than wing, or else longer than exposed culmen, the feathers not pointed in either sex .................... *Doricha.**

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* *Phaëthornis* SWAINS., Zool. Jour. 1827, 357. Type *Trochilus superciliosus* LINN. (Two species from southern Mexico southward, and numerous species in South America.)

† *Eupherusa* GOULD, Mon. Troch. pt. XIV. 1857. Type, *Ornismya eximia* DELATTR. (One species in southern Mexico, another in Guatemala, a third in Costa Rica and Veragua.)

‡ *Abeillia* BONAP., Consp. I, 1850, 79. Type, *Ornismya abeillei* DELATTR. (One species in southern Mexico and Central America.)

§ *Sphenoproctus* CAB. and HEIN., Mus. Hein. III. 1860, 11. Type, *Ornismya pampa* LESS. (One species in southern Mexico, another in Guatemala.)

‖ *Lamprolaima* REICH., Aufz. der Colib. 1853, 9. Type *Ornismya rhami* LESS. (One species in highlands of Mexico and Guatemala. The male has the throat purplish red, the other under parts rich purplish blue.

¶ *Floricola* ELLIOT, Class. and Synop. Troch., Sept. 1878, 82. Type, *Trochilus longirostris* VIEILL. (Two species inhabiting pine forests of Mexican highlands, another in Guatemala, two or three others in mountains of northern South America.)

$f^2$. Exposed culmen less than half as long as wing.

$g^1$. Tail 2.25 or more, rounded, feathers very broad the three outermost broadly tipped with white in both sexes; shafts of three outer quills very strong, often enormously thickened............*Campylopterus.*†

$g^2$. Tail less than 2.25.

$h^1$. Tail more than three-fourths as long as wing; forked for more than one-fourth its length, the feathers broad and rounded at tips; adult males wholly bright green beneath, the tail blue-black or bronze-black.

$i^1$. Middle tail-feathers blue-black, like the rest (tipped with dull grayish in the Mexican species); females and young males with outer tail-feathers grayish white or pale grayish at tip and base, blue-black in middle portion..........*Chlorostilbon.*‡

$i^2$. Middle tail-feathers bronzy; females and young males without grayish base or tip to outer tail-feathers ...........*Sporadinus.*§

$h^2$. Tail less than three-fourths as long as wing, variously shaped, but never forked for more than one fourth its length; adult males never entirely green beneath.

$i^1$. Lower parts white, the sides sometimes green or spotted with green; sexes alike.

$j^1$. Exposed culmen decidedly more than half as long as tail; top of head usually metallic blue or violet..............*Uranomitra.*‖

$j^2$. Exposed culmen not more than half as long as tail; top of head never blue or violet ..............................*Agyrtria.*¶

$i^2$. Lower parts never pure white.

$j^1$. Tail bright bluish green or greenish blue, crossed near end by a broad band of blue-black ....................*Petasophora.***

$j^2$. Tail *not* bright bluish green, etc.

$k^1$. Feathering of forehead extended forward as far as anterior end of nostrils and partly or entirely covering the scale over the nostrils.

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* *Doricha* REICH., Aufz. der Colib. 1853 12. Type, *Trochilus enicurus* VIEILL. (One Mexican, one Guatemalan, one Costa Rican, and two Bahaman species.)

† *Campylopterus* SWAINS., Zoöl. Jour. 1826, 328. Type, *Trochilus largipennis* BODD. (One Mexican species—a splendid bird—one peculiar to Guatemala, and several in northern South America. The first, *C. hemileucurus* (LICHT.), is the largest humming bird found north of the Isthmus of Panama, being nearly 6 inches in length. It is very possibly the species to which Dr. R. W. Shufeldt, U. S. A., refers in a letter dated June 9, 1886, as having been seen by him the day before, near Fort Wingate, New Mexico, and which he described as being "fully large enough for *Eugenes fulgens*, and whirred like an old quail.")

‡ *Chlorostilbon* GOULD, Mon. Troch, pt. v, 1853. Type, *Trochilus pucherani* BOURC. and MULS. (Three species in Mexico, one in Porto Rico, and about six in South America.)

§ *Sporadinus* BONAP., Rev. et Mag. Zoöl. 1854, 255. Type, *Trochilus riccordi* GERV. (One species in Haiti, one in Cuba and Bahamas, and apparently one peculiar to Bahamas.)

‖ *Uranomitra* REICH., Aufz. der Colib. 1853, 10. Type, *Trochilus franciæ* BOURC. and MULS. (Four species in Mexico, one in Honduras, one in Colombia, and one in Peru.)

¶ *Agyrtria* REICH., Troch. Enum. 1855, 7. Type, *Trochilus brevirostris* LESS. (Two Mexican and numerous South American species; some of the latter with lower parts mostly green; one of the former, with buffy or rufous belly and flanks.)

** *Petasophora* GRAY, List Gen. B. 1840, 13. Type, *Trochilus serrirostris* VIEILL. (One species in Mexico and Guatemala, several in Central and South America.)

$l^1$. Wing more than 2.40; adult males without a brilliant gorget, or else the latter neither red, purple, nor violet.

$m^1$. Tail partly rich chestnut, glossed with bright purple; bill rather distinctly curved..............*Lampornis.**

$m^2$. Tail without chestnut or bright purple; bill straight.

$n^1$. Tail wholly (male) or partly (female) greenish bronze· *Eugenes.* (P. 319.)

$n^2$. Tail wholly or chiefly black......*Cœligena.* (P. 323.)

$l^2$. Wing less than 2.25; adult males with a brilliant gorget of metallic red, purple, or violet.

$m^1$. Middle tail feathers narrower near end than at base.

$n^1$. Exposed culmen 0.60 or more; outer tail feathers tipped with white only in females.

$o^1$. Outer tail feather not decidedly shorter than middle pair, and not conspicuously narrower than the next; adult males with six innermost quills abruptly much smaller and narrower than the rest. *Trochilus.* (P. 325.)

$o^2$. Outer tail feather decidedly shorter than the middle pair and abruptly narrower than the next (except in *C. helenæ*); adult males with innermost quills normal.

$p^1$. Tail without any rufous; adult males with tail forked (but feathers not pointed) and top of head brilliantly metallic, like gorget. *Calypte.* (P. 333.)

$p^2$. Tail partly rufous, more or less graduated, in both sexes; adult males with top of head greenish or bronzy, totally unlike gorget (except in *S. floresii*)....................*Selasphorus.* (P. 339.)

$n^2$. Exposed culmen not more than 0.50; outer tail feathers tipped with white in both sexes....*Atthis.* (P. 379.)

$m^2$. Middle tail feathers broader near end than toward base. *Stellula.* (P. 354.)

$k^2$. Feathering of forehead scarcely extending beyond posterior portion of nostrils, the scale over latter therefore naked for the greater part at least; bill very broad at base.

$l^1$. Tail blue-black in male, deeply emarginated, the middle feathers tipped with dull grayish; in female shallowly emarginate, green basally, blue-black terminally, the outer feathers tipped with grayish white; adult males metallic green beneath, the throat bluish. *Iache.* (P. 371.)

$l^2$. Tail not blue-black, etc.

$m^1$. Exposed culmen more than half as long as tail.

$n^1$. Tail rufous or chestnut, the feathers usually with dusky or bronzy terminal margins......*Amazilia.* (P. 362.)

$n^2$. Tail dull greenish, with dusky subterminal band (except on middle feathers), the outer feathers tipped with dull, light grayish brown; plumage in general very dull, the lower parts dull brownish gray...............................*Phæoptila.*†

$m^2$. Exposed culmen not more than half as long as tail. *Basilinna.* (P. 3[illegible]8.)

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* *Lampornis* SWAINS., Zoöl. Jour. III. 1827, 358. Type, *Trochilus mango* LINN. (One Mexican, several West Indian, and several South American species.)

† *Phæoptila* GOULD, Intr. Mon. Troch. Oct. ed., 1861, 169. Type, *Cyanomyia* (?) *sordida* GOULD. (The single known species peculiar to Mexico.)

In order to render the present work more useful to those who wish to know more about the Humming Birds of our country, the principal synonymy, a description, and a brief account of the habits of each species (so far as known), is given in the following pages.

### GENUS **EUGENES** GOULD.

*Eugenes* GOULD, Mon. Troch. pt. XII, 1856; Introd. Troch. Oct. ed., 1861, 57. Type, *Trochilus fulgens* SWAINS.

GENERIC CHARACTERS.—Tail less than two-thirds as long as wing, slightly forked or emarginated; bill straight, more than one-third as long as the wing and about half as long as the longest tail feathers. Size, large (total length, 4.50 inches or more; wing, 2.90–3.10).

*Adult males* with top of head rich metallic violet or violet-blue, the chin and throat brilliant emerald-green or light bluish green; upper parts dark bronzy green; lower parts (except throat and lower tail-coverts) plain dusky greenish or dull bronzy; lower tail-coverts paler greenish or bronzy, bordered with paler. *Adult females* with top of head dull brownish gray or grayish brown, rest of upper parts bronzy green; lower parts pale brownish gray, the sides and flanks tinged with green; a small white postocular spot.

There are only two species known of this genus, one (*E. fulgens*) inhabiting the highlands of Guatemala and Mexico, north to southern Arizona, the other (*E. spectabilis*) the elevated portions of Costa Rica. They may be distinguished by the following characters:

$a^1$. *Adult male:* Breast very dark bronzy green, appearing nearly black in some lights. *Adult female:* Outer tail-feathers very broadly (for about .35–.45) tipped with pale gray or dull grayish white. Exposed culmen 1.15. *Young:* Similar to adult female, but feathers of upper parts bordered terminally with pale buffy. *Hab.* Highlands of Mexico and Guatemala, north to southern Arizona. *E. fulgens* (SWAINS). *Rivoli Humming Bird.* (P. 319.)

$a^2$. *Adult male:* Breast dull bronzy, or bronzy green, the feathers dull brownish gray immediately beneath surface; lower tail-coverts green, margined with pale buffy. *Adult female:* Outer tail-feathers more narrowly (for about .20–.25) tipped with darker brownish gray; exposed culmen 1.40–1.50. *Hab.* Highlands of Costa Rica. *E. spectabilis* (LAWR). *Admirable Humming Bird.*[*]

### RIVOLI HUMMING BIRD. *Eugenes fulgens* (SWAINS).

(Plate XXXV.)

*Trochilus fulgens* SWAINS. Phil. Mag. I, 1827, 441.

*Eugenes fulgens* GOULD, Mon. Troch. pt. XII, 1856, pl. 7; vol. II, 1861, pl. 59. —HENSHAW, Am. Nat. 1874, 241 (Camp Grant, Arizona); Zoöl. Wheeler's Surv. 1875, 379.

Refulgent Humming Bird.

L'Eugene de Rivoli (MULSANT and VERREAUX).

Chupamirto verde montero (Puebla; Prof. F. FERRARI-PEREZ).

Chupamirto real de pecho verde y cabeza azul (D'OCA).

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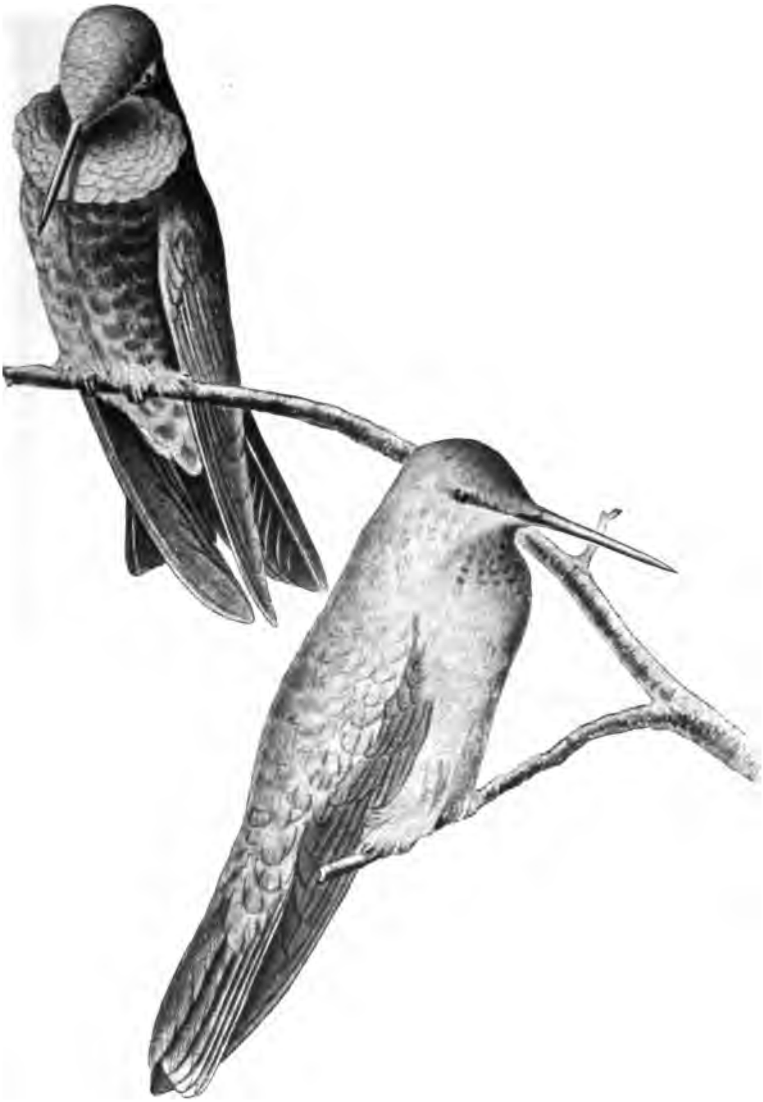
[*] *Heliomaster spectabilis* LAWR., Ann. Lyc. N. Y. VIII. 1867, 472. *Eugenes spectabilis* MULS., Hist. Nat. Ois. Mouch. II., 1876, 215.

**RANGE.**—Table-lands of Guatemala and Mexico; north to southern Arizona.

**SP. CHAR.**—*Adult male* with crown rich royal purple or hyacinth-blue, throat glittering emerald-green, chest black glossed with bronze or bronze-green, wing-coverts and lower back bronze-green, and tail uniform, bronzy; female and young bronzy-green or bronzy above, dull grayish beneath, more or less spotted with bronze on throat and sides; outer tail-feathers black subterminally, the exterior two to four tipped with pale gray or grayish white: length about 4.50–5.00 inches.

*Adult male* (No. 105650, Puebla, Mexico, September, 1884; Prof. F. Ferrari-Perez): Forehead dull blackish, with a faint dull green gloss; crown rich metallic royal purple varying to hyacinth-blue, bordered laterally and posteriorly by metallic bronze-green (appearing velvety black when viewed from in front); hind neck, back, scapulars, wing-coverts, rump, and upper tail-coverts metallic bronze-green or greenish bronze; tail uniform deep greenish bronze (more decidedly greenish on middle feathers; remiges dull brownish slate or grayish brown, with a very faint purple gloss. Gorget (including whole throat, chin, and malar region, and extending back much farther laterally than medially) brilliantly metallic yellowish emerald-green, changing to bluish ("beryl") green; chest, breast, and upper median portion of belly deep velvety black when viewed from in front, but metallic greenish bronze when viewed from behind; flanks and lower belly dull grayish brown glossed with greenish bronze; under tail-coverts paler grayish brown, indistinctly margined with pale dull buff; downy femoral tufts white. Lores deep black; a white spot at posterior angle of the eye. Bill entirely deep black; feet dusky. Length (skin), 4.75; wing, 2.90; tail, 1.90 (middle feathers, 1.55); exposed culmen, 1.00.

*Adult female* (No. 105706, Jalapa, Mexico; Prof. F. Ferrari-Perez): Above bright green, tinged with bronze, becoming duller on top of head, where passing into dull dusky brownish gray on forehead; tail-feathers (except middle pair) bronze green basally, black subterminally, and pale brownish gray terminally, the latter color, also the black, most extensive on the outer feather; remiges uniform slate-brown, very faintly glossed with purple, the tertials with very narrow and inconspicuous terminal margins of white. Lores dusky, with an obliquely horizontal bar of white on the lower portion; a distinct white spot behind the eye. Malar region, chin, and throat dull white, the feathers light brown medially, forming rather distinct stripes, converging on the chin; sides of head beneath eyes (including auriculars), sides of neck, and lateral portions of the body beneath, light brownish gray, the feathers indistinctly margined with whitish, and those on the sides of the breast faintly washed with bronze; under tail-coverts pale brownish gray bordered with white; middle of belly and median line of breast and chest dull white; downy femoral tufts white. Bill black, the lower mandible more brownish, except the terminal portion. Wing,



RIVOLI HUMMING BIRD (*Eugenes fulgens*).
**Male.** (Cat. No. 105746, U. S. N. M. Puebla, Mexico. Collected by Prof. F. Ferrari-Perez.)
**Female.** (Cat. No. 105706, U. S. N. M. Puebla, Mexico. Collected by Prof. F. Ferrari-Perez.)

2.60; tail, 1.55 (middle feathers only .10 shorter); exposed culmen, 1.15.*

*Immature male* (No. 105704, Jalapa, Prof. F. Ferrari-Perez): Intermediate in coloration between the adult male and female, as described above, the crown only partly violet, the throat only partly green, chest slightly mixed with black, etc., the tail exactly intermediate both in form and color. Wing, 2.90; tail, 1.85 (middle feathers .20 shorter); exposed culmen, 1.09.

*Young female* (No. 99367, Santa Rita Mountains, Arizona, July 5, 1884, E. W. Nelson): Similar to the adult female as described above, but all the contour feathers of the upper parts margined with pale buffy-grayish, and under parts darker, with entire sides distinctly glossed with bronze-green.

This fine Humming Bird was first described by Swainson, in 1827, but only two years later was redescribed by Lesson, who give it the specific name *Rivoli*, in honor of M. Massena, Prince of Essling and Duke of Rivoli. Mr. Gould refers to it as being celebrated "for the beauty of its coloring and the bold style of its markings;" and it is, indeed, one of the finest of the Mexican species, both as to size and beauty of plumage.

The habits of the Rivoli Humming Bird are this described by Mr. Salvin, in The Ibis, 1860, pages 261, 262:

> This species is rare at Coban. The place described as frequented by *Amazilia dumerilii*† is where I have found this species in greatest numbers; indeed, with two exceptions, I have never met with it elsewhere near Dueñas. It is a most pugnacious bird. Many a time have I thought to secure a fine male, which I had perhaps been following from tree to tree, and had at last seen quietly perched on a leafless twig, when my deadly intention has been anticipated by one less so in fact, but to all appearance equally so in will. Another Humming Bird rushes in, knocks the one I covet off his perch, and the two go fighting and screaming away at a pace hardly to be followed by the eye. Another time this flying fight is sustained in midair, the belligerents, mounting higher and higher till the one worsted in battle darts away seeking shelter, followed by the victor, who never relinquishes the pursuit till the vanquished, by doubling and hiding, succeeds in making his escape. These fierce raids are not waged alone between members of the same species. *Eugenes fulgens* attacks with equal ferocity *Amezilia dumerilii*, and, animated by no high-souled generosity, scruples not to tilt with the little *Trochilus colubris*. I know of hardly any species that shows itself more brilliantly than this when on the wing, yet it is not to the midday sun that it exhibits its splendor. When the southerly winds bring clouds and driving mists between the volcanoes of Agua and Fuego and all is as in a No-

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* The dimensions of an adult female taken May 28, 1888, in Carr's Cañon, Huachuca Mountains, Arizona, by Mr. Will W. Price, are as follows: Length (skin), 4.80; wing, 2.70; tail, 1.70; exposed culmen, 1.10.

† The "western boundary of the llaño of Dueñas, which, starting from the village, and bounded to the eastward by the river Guacalate, extends, sweeping by the base of the Volcan de Fuego, almost to the Hacienda of Capertillo, its southern extremity. Dispersed over this plain is found, in groves, patches, and isolated trees, a Tree-Convolvulus, bearing a white flower and attaining an average height of about 25 or 30 feet."

vember fog in England, except that the yellow element is wanting, then it is that *Eugenes fulgens* appears in numbers; *Amazilia devillei*, instead of a few scattered birds, is to be seen in every tree, and *Trochilus colubris* in great abundance. Such animation awakes in Humming Bird life as would hardly be credited by one who had passed the same spot an hour or two before; and the flying to and fro, the humming of wings, the momentary and prolonged contests, and the incessant battle cries seem almost enough for a time to turn the head of a lover of these things. I have fifteen males from Dueñas to one female.

The Rivoli Humming Bird was first added to the fauna of the United States by Mr. H. W. Henshaw, while acting in the capacity of naturalist to Lieutenant Wheeler's expedition, under the auspices of the Engineer Department, U. S. Army. On September 24, 1873, a single immature female was taken by him in the immediate vicinity of Camp Grant, Arizona. It was found along a small stream issuing from the mountains, and when first seen was being pursued by another hummer which Mr. Henshaw is sure was the same species. The following year, he again found it in that Territory, though not in the same locality.

Fully expecting [says he*] to find this species a summer inhabitant of the mountain districts of southern Arizona, I was not surprised when, on reaching Mount Graham, I found the supposition verified. During the first three days of August I secured two adult males and another female. In talking with the lumbermen of the neighborhood I learned that the large Humming-Birds had been quite common earlier in the summer, but at that time they had nearly disappeared, though the smaller birds (*S. platycercus*) were still quite numerous. I suppose that during the mating season they had made themselves more conspicuous, and indeed had probably frequented the little valley in which the cabins of these men were built in considerable numbers, but had retired, each to some secluded spot deeper in the mountains to rear their young.

A very beautiful nest was discovered, which save its large size resembles in its construction the best efforts of the little eastern Ruby Throat. It is composed of mosses nicely woven into an almost circular cup, the interior possessing a lining of the softest and downiest feathers, while the exterior is elaborately covered with lichens, which are securely bound on by a network of the finest silk from spiders' webs. It was saddled on the horizontal limb of an alder, about twenty feet above the bed of a running mountain stream, in a glen which was overarched and shadowed by several huge spruces, making it one of the most shady and retired nooks that could be imagined. The two young which it contained had just been hatched, and the female was returning to the nest when I caught sight of her, having probably carried away the broken eggshell, fragments of which were still in the nest. The dimensions of the nest are as follows: Depth, externally, 1.50; internally, 0.75; greatest external diameter, 2.25: internal diameter, 1.15.

The most recent information that we have respecting the habits of this species is by Mr. Otho C. Poling, in The Auk for October, 1890 (pages 402, 403), which is as follows:

This Humming Bird is a summer resident in the Huachuca Mountains, Arizona. It arrives in May, but is nowhere plentiful until the mescal shrubs begin to blossom, about the middle of June. From this time on during the entire summer one may observe on almost any hillside below the pine belt large clusters of bright red or yellow flowers spreading out from the stalks 10 or 15 feet high. There are many varieties of this plant and all are favorite feeding resorts of the Rivoli Hummer. I have shot as many as a dozen in a day simply by sitting down and watching for them to come and feed. It is necessary to select a well-matured plant, and at the proper elevation, as well as in good surroundings of spruce pines. While feeding these birds range from 4,500 to 8,000 feet altitude or up to the pine belt, their favorite grounds being where the pines end on the downward slope. Their flight is exceedingly rapid at times, but they often fly slowly so that the wings can be easily seen during the beats. The noise made by this bird's wings during a rapid flight is not like the buzzing of the small Hummers' wings, the beats being more slow and distinct, without any buzzing noise.

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* Ornithology of Wheeler's Exp., 1875, pp. 379, 380.

Their note is a twittering sound, louder, not so shrill, and uttered more slowly than those of the small Hummers.

From July 5 to 9 I examined nine females; one had already laid and the other contained eggs that would probably have been laid within from 1 to 4 days. On July 10 my search for the nest was at last rewarded. The country I had explored was from 7,500 to 10,000 feet elevation, where a dense growth of tall spruce pines covers the hillsides. These pines are all more or less covered with bunches of moss and lichens. I was resting on a rock in the cool shade beneath one of these trees when I was suddenly attracted by the noise of a Hummer's wings close to my head. Looking up I saw a female Rivoli making perpendicular dives at me. After repeating this until I had moved off a sufficient distance, she alighted upon a small dead twig and there sat watching me for some moments. As all remained quiet she now flew about the tree slowly, and when about 50 feet up made a rapid dart to the crotch of a mossy limb about 10 feet from the trunk, where the nest was built, nearly hidden from the ground. I now came up, and by throwing things at her flushed her off the nest, but she at once returned to it. After much trouble the nest and the two eggs it contained were secured in safety.

The nest was firmly attached to the limb just beyond a crotch, the limb at the nest being about an inch in diameter. It is of a uniform oval shape, its diameter outside being from 2.03 to 2.62 inches; inside from 1.20 to 1.45. The depth outside is 1.55 inches; inside it is 0.62. It is composed outwardly of bits of fine moss and lichens, and is indistinguishable from the limbs about it. It is well lined on the inside with many star-shaped downy seeds of a delicate cream color, similar to those of the common thistle of the East, but smaller and softer. The two eggs are pure white, shaped alike at both ends, and measure 0.53 by 0.37 and 0.52 by 0.37 inch.

### Genus CŒLIGENA Lesson.

*Cœligena* Less., Ind. and Synop. Gen. Troch. 1832, p. xviii. Type, *Ornismya clemenciæ* Less.

*Delattria* Bonap., Consp. i, 1850, 70. Type, *Ornismya henrica* Less. and Delattre.

*Chariessa* Heine, Jour. für Orn., May, 1863, 178. Type, *Ornismya henrica* Less. and Delattre.

*Himelia* Muls., Cat. Ois Mouch, 1875, 7. Type, *Ornismya henrica* Less. and Delattre, (*fide* Elliot).

Generic characters.—Tail more than two-thirds as long as wing, slightly rounded or double-rounded, the feathers very broad; bill nearly straight, less than one-third as long as the wing, and less than half as long as the longest tail-feathers. Size, large (total length 4.25 or more; wing, 2.60 or more). Colors, above rather dull metallic greenish, changing to purplish-black on upper tail-coverts and tail (except in *C. hemileuca*); ear-coverts dusky, or else brilliant green, always bordered above by a distinct white stripe; *adult males* with the throat metallic blue, pale violet or amethyst, reddish purple, or pale emerald-green.

Five species have been referred to this genus, but it is questionable whether all of them really belong to it. They may be distinguished as follows:

$a^1$. Outer tail-feathers broadly tipped with white in both sexes. (*Cœligena* LESS.) Lower parts dull gray, glossed with green on sides; male with the throat metallic cobalt blue. *Hab.*: Highlands of Mexico, north to southern Arizona; Guatemala. *C. clemenciæ* LESS. *Blue-throated Humming Bird.* (Page 324.)

$a^2$. Outer tail-feathers not tipped with white in either sex. (*Delattria* BONAP.)

$b^1$. Lower parts dull grayish, glossed with green on sides.

$c^1$. Adult male with throat metallic reddish purple. *Hab.*: Highlands of Guatemala. *C. henrica* (LESS. and DELATT.). *Henri Delattre's Humming Bird.*[*]

$c^2$. Adult male with throat metallic violet. *Hab.*: Sierra Madre of southern Mexico. *C. margaritæ* SALV. and GODM. *Mrs. Smith's Humming Bird.*[†]

$b^2$. Lower parts white medially, metallic green laterally.

$c^1$. Ear-coverts dusky green; top of head moderately metallic (green); adult male with throat pale emerald-green, the feathers margined with white. *Hab.*: Highlands of Guatemala.
*C. viridipallens* (BOURC. and MULS.). *Pale-green-throated Humming Bird.*[‡]

$c^2$. Ear-coverts and top of head brilliantly metallic emerald-green; adult male with throat pale violet or amethyst. *Hab.*: Highland of Costa Rica.
*C. hemileuca* (Salv.). *Amethyst-throated Humming Bird.*[§]

### BLUE-THROATED HUMMING BIRD. *Cœligena clemenciæ* LESS.

(Plate XXXVI.)

*Ornismya clemenciæ* LESS., Ois. Mouch., 1829, 216, pl. 80.

*Cœligena clemenciæ* LESS., Ind. and Synop. Gen. Troch. 1832, lp. XVIII. BREWST., Auk, II, Jan., 1885, 85 ("Camp Lowell," Arizona); Apr. 1885, 199 (correction of locality—Sta Catalina Mountains, not Camp Lowell).

*Delattria clemenciæ* BONAP., Consp. I, 1850, 70.—GOULD, Mon. Troch. pt. IX, 1855, pl. 10; vol. II, 1861, pl. 60.

Clemence's Humming Bird.
Blue-throated Cazique (GOULD).
Le Cœligène de Clémence (MULSANT and VERREAUX).
Oiseau-Mouche de Clémence (LESSON).
Chupamirto real de pecho azul celeste (D'OCA).

RANGE.—Highlands of Mexico, north to southern Arizona.

SP. CHAR.—Size, very large (length more than 4.50, wing 2.90—3.20); lower part dull gray, glossed with green on sides; middle tail-feathers black, and outer ones broadly tipped with white in both sexes; adult male with throat shining blue.

*Adult male* (No. 76829, Mexico; Mrs. Chauncy Riley): Forehead and crown dull bronze-green, appearing dull olive in certain lights; occiput, hind-neck, back, scapulars, and wing-coverts much brighter green (nearly a grass-green), lower back and rump light, rather dull, bronze-

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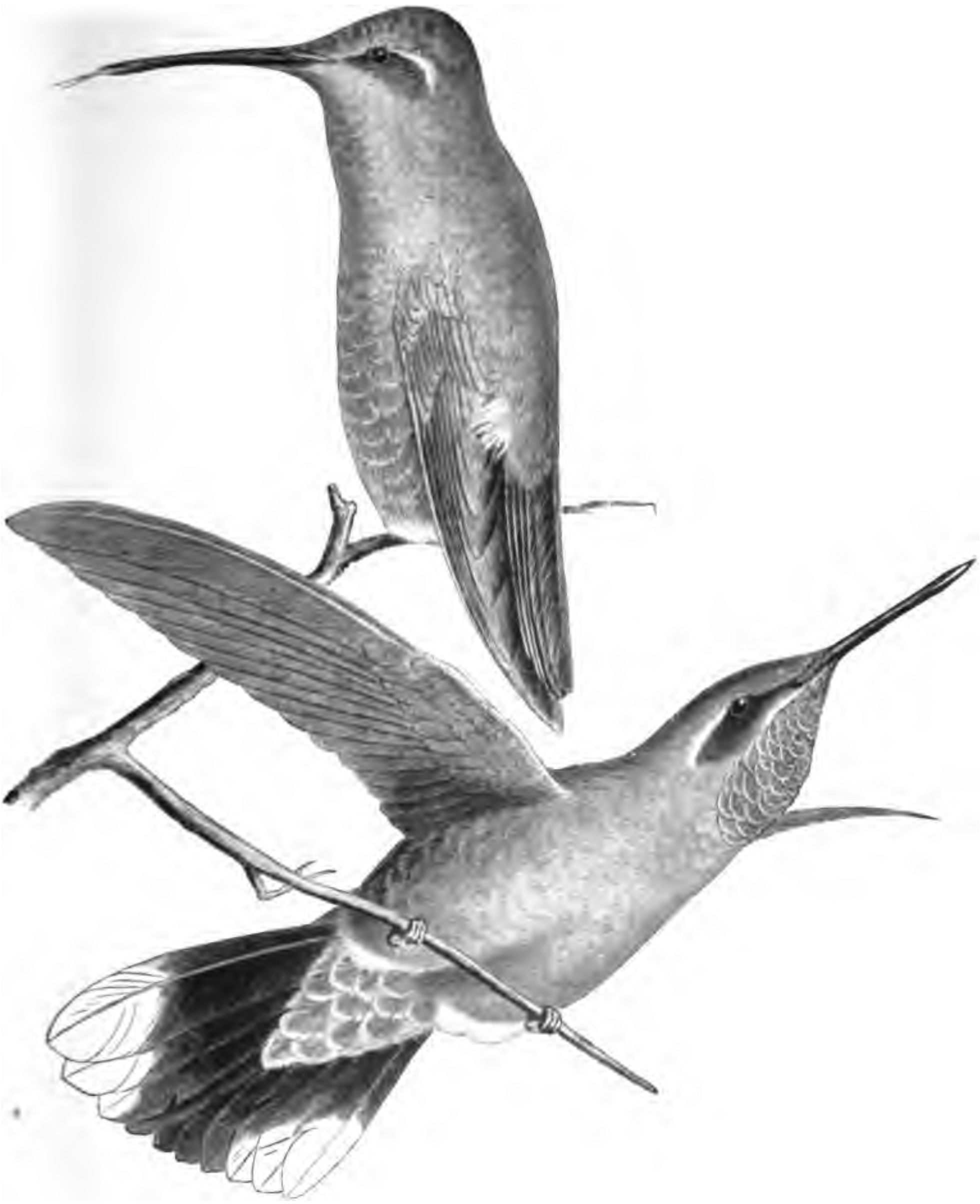
[*] *Ornismya henrica* LESS. and DELATTR., Rev. Zool. 1839, 17. *Cœligena henrici* CAB. and HEIN., Mus. Hein. III. 1860, 15.

[†] *Delattria margaritæ* SALV. and GODM., Ibis, Apr. 1889, 239.

[‡] *Trochilus viridipallens* BOURC. and MULS., Ann. Soc. Lyons, 1846, 321. *Cœligena viridipallens* MULS., Hist. Nat. Ois. Mouch. I. 1877, 185.

[§] *Oreopyra hemileuca* SALV., P. Z. S. 1864, 584. *Cœligena hemileuca* ELLIOT, Class. and Synop. Troch. 1879, 31.



BLUE-THROATED HUMMING BIRD (*Cœligena clemenciæ*).
**Male.** (Cat. No. 76829, U. S. N. M. Mexico. Collected by Mrs. Chauncy Riley.)
**Female.** (Cat. No. 35159, U. S. N. M. Mirador, Mexico. Collected by Dr. C. Sartorius.)

green, the feathers showing narrow and indistinct paler margins; upper tail-coverts similar, but much darker; tail black, faintly glossed with dull blue, the three outer feathers broadly tipped with white, this broadest (about .70 of an inch) on outer web of exterior feather; remiges dull brownish slaty, very faintly glossed with purplish. A white streak behind eye, above upper margin of ear-coverts, the latter dusky; this color extending beneath eye to, and including, lores; beneath the latter, a buffy, or rusty-whitish rictal streak extends as far back as beneath middle of eye. A large patch, with convex posterior outline, covering chin and whole throat, metallic cobalt-blue, each feather narrowly margined with pale brownish gray—these edgings very conspicuous in certain lights and causing a scale-like appearance; rest of under parts dull brownish gray, the lateral portions glossed with bronze-green, and under tail-coverts broadly margined with white; downy femoral tufts dull white. Bill entirely black. Length (skin), 5.00[*]; wing, 3.15; tail, 2.20 (middle feathers 2.00); exposed culmen, .92.

*Adult female* (No. 35159, Mirador; Dr. C. Sartorius): Similar to the adult male, but chin and throat dull brownish gray, similar to but a little paler than the color of the breast, etc. Length (skin), 4.40; wing, 2.80; tail, 1.90; exposed culmen, 1.00.

This large and rather dull-colored species of Humming Bird, named in honor of Madame Clémence Lesson, was first added to the United States fauna by Mr. F. Stephens, who on May 14, 1884, took an adult male in the Santa Catalina Mountains, near Camp Lowell, Arizona, as recorded by Mr. William Brewster, in The Auk, January, 1885, p. 85.[†] It has since been taken in various localities in the southern part of that Territory by different collectors (among whom may be named Mr. Will. W. Price and Mr. Otho C. Poling), but so far as we are aware nothing has been published by them regarding its habits.

Mr. Gould says that he believes the true and restricted habitat of this species to be the moderately high table-land of Mexico, and he adds that, "it is a large and powerful bird . . . distinguished for the quietness of its coloring rather than for any of those brilliant metallic markings so prevalent among humming birds in general."

### Genus **TROCHILUS** Linnæus.

*Trochilus* Linn., S. N. ed. 10, I. 1758, 119. Type, by elimination, *T. colubris* Linn.
*Cynanthus* Boie, Isis, 1831. Type, *T. colubris* Linn.
*Colubris* Reich., Syst. Av. Nat. 1849, pl. 40. Type, *T. colubris* Linn.
*Archilochus* Reich., Aufz. Colib. 1854, 12. Type, *Trochilus alexandri* Bourc. and Muls.
*Ornismya* Muls. and Verr., Class. Troch. 1865, 91 (*nec* Less., 1829). Type, *T. alexandri* Bourc. and Muls.

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[*] The measurements before skinning of a male taken at Camp Lowell, Arizona, by Mr. F. Stephens, were as follows: Length, 5.40; extent, 7.50; wing, 3.10; tail, 1.91; culmen from nostril, .88. A skin collected in the Huachuca Mountains, Arizona, by Mr. Will W. Price, measures as follows: Length, 5.00; wing, 3.10; tail, 2.00; exposed culmen, .85.

[†] The locality was first given as Camp Lowell, but this was subsequently corrected (The Auk, April, 1885, p. 199).

GENERIC CHARACTERS.—Male with the metallic gorget not elongated laterally. Tail forked or deeply emarginate, the feathers pointed, but the exterior ones not excessively narrow. Six inner primaries abruptly and conspicuously smaller than the rest, with their inner web more or less notched and toothed at the tip (except in *T. violajugulum*).

The peculiarity above noted in the reduced size and modified form of the six inner primaries is most marked in *T. colubris*, and may be more particularly described as follows: The outer four primaries are of the usual shape, and diminish gradually in size; the remaining six, however, are abruptly much smaller, more linear, and nearly equal in width (about that of inner web of the fourth), so that the interval between the fifth and fourth is from two to five times as great as that between the fifth and sixth. The inner web of these reduced primaries is also emarginated at the end. This character is even sometimes seen in the females, but to a less extent, and may serve to distinguish both *colubris* and *alexandri* from other allied species where other marks are obscured.

In *T. violajugulum* the inner primaries are not obviously abnormal either in size or shape, there being, as is usually the case in Humming Birds, a gradual decrease in size from the outer quill. A very close inspection, however, will show that while the distinct emargination at the tip of the inner web of these remiges in *T. colubris* and *T. alexandri* is wanting, there is an indication of the tooth-like projection just anterior to the end of the web. In fact, *T. alexandri* is very nearly intermediate in this respect between *T. violajugulum* and *T. colubris*, though nearest the latter.

The female has the outer tail feathers somewhat lanceolate, as in the male, though much broader. They are broad to the terminal third, where they become rapidly pointed, the tip somewhat rounded; the sides of this attenuated portion (one or other, or both) broadly and concavely emarginated, which distinguishes them from the females of *Selasphorus* and *Calypte*, in which the feathers are broadly linear to near the end, which is much rounder and without any distinct concavity.

The genus *Trochilus*, as here restricted, includes three species, all belonging strictly to North America, though like many other Nearctic birds they winter chiefly within the tropics. One is eastern, the other two western, in distribution, one of the latter being, so far as known, very local in its range.

The three species agree in the following characters of coloration: Upper parts, including top of head, metallic greenish, varying from nearly pure green to bronzy; median lower parts whitish, the sides metallic green; adult males with a portion of the gorget brilliantly metallic red, rose-purple or violet, the anterior portion velvety black; tail-feathers (except middle pair) uniform purplish black. *Adult females* and *young* with chin and throat dull whitish, or pale grayish (sometimes spotted centrally with the metallic color of the male), the rectrices (except middle pair) greenish basally, black subterminally, and tipped with white.

They may be distinguished by the following characters:

$a^1$. Adult males with chin only and a line thence along anterior lateral edge of gorget opaque black, the remainder of the gorget reddish.

$b^1$. Gorget fiery metallic crimson or ruby-red, changing to golden red. *Hab.* eastern North America. *T. colubris* LINN. *Ruby-throated Humming Bird.* (Page 327.)

$b^2$. Gorget auricula-purple. *Hab.* Santa Barbara, California.
*T. violajugulum* JEFFRIES. *Violet-throated Humming Bird.*(Page 329.)

$a^2$. Adult male with more than upper half of gorget opaque black. Lower part of gorget metallic violet. *Hab.* western North America.
*T. alexandri* BOURC. and MULS. *Black-chinned Humming Bird.* (Page 331.)

### RUBY-THROATED HUMMING BIRD. *Trochilus colubris* LINN.

(Plate XXXVII.)

*Trochilus colubris* LINN., S. N. ed. 10, I, 1758, 120.—WILS., Am. Orn. II, 1810, 26, pl. 10, figs. 3, 4.—NUTT., Man. I, 1832, 588.—AUD., Orn. Biog. I, 1832, 248; V, 1839, 544, pl. 47; Synop. 1839, 170; B. Am. IV, 1842, 190, pl. 253.—GOULD, Mon. Troch. III, 1861, pl. 131.—B. B. and R., Hist. N. Am. B. II. 1874, 448, pl. 47, fig. 2.
*Trochilus aurigularis* LAWR., Ann. Lyc. N. H. N. Y. VII, Feb. 1862, 458.
Northern Humming Bird (SWAINSON).
Red-throated Humming Bird.
L' Ornismya petit rubis (MULSANT and VERREAUX).
Chupamirto rubi (FERRARI-PEREZ).
Chupamirto color de fuego (D'OCA).

RANGE.—In summer, the whole of temperate eastern North America, north in the interior, to latitude 59°, west to the Great Plains. In winter, from southern Florida (Punta Rassa, Key West, etc.), Bahamas, Cuba, Porto Rico, and eastern Mexico through Central America as far as Veragua; Bermudas.

SP. CHAR.—*Adult male:* Chin, and a line thence backward to beneath the eye, opaque velvety black, the rest of the gorget intense metallic crimson, changing to golden red; tail forked for about 0.30–0.35; length about 3.07–3.75, wing 1.60, tail 1.25, exposed culmen 0.55–0.65. *Adult female:* Tail double-rounded, the outer feathers about as long as middle pair (sometimes a little shorter), the middle pair wholly green, the rest green basally, then black, the three outer pairs broadly tipped with white; length about 3.50–3.90, wing 1.80, tail 1.20, culmen 0.70. *Young male:* Similar to adult female, but throat streaked with dusky, feathers of upper parts more or less distinctly margined with pale buffy, and tail more forked. *Young female:* Similar to young male, but throat without streaks, and tail more rounded.

*Adult male* (No. 2713, Washington, District of Columbia, 1843; S. F. Baird): Above metallic bronze-green, becoming darker and duller on top of the head, where the metallic gloss almost disappears on the forehead—the green brightest on rump, upper tail-coverts, and middle pair of tail-feathers; remiges dull slate-blackish, with a faint purplish gloss; tail-feathers (except middle pair) darker and with more distinct purple gloss. A small white spot at posterior angle of eye; lores, chin, and stripe beneath eyes, on each side of gorget, and extending nearly to the end of the same across ear-coverts, velvety opaque black; rest of gorget intensely bright metallic crimson or ruby-red, changing to brassy or golden and even greenish in certain lights. Chest dull grayish white, the median line of the breast and belly similar, but darker; sides and flanks deep sooty-grayish strongly glossed with bronze-green; under tail-coverts light grayish brown or brownish gray broadly margined with dull whitish. Bill wholly black; feet blackish. Length (skin), 3.15*; wing, 1.60; tail, 1.20, the middle feathers 0.30 shorter; exposed culmen, 0.60.

*Adult female* (No. 1101, Washington, District of Columbia, 1843; S. F. Baird): Above, similar in color to the male; tail-feathers, however, except two middle pairs, tricolored, the basal portion bronze-green, tips white, and intermediate portion black, the white broadest (about 0.30 of an inch along shaft) on outer feather, the black nearly the same width (about 0.35 along shaft) on all, the fourth feather tipped with black for about 0.25 of an inch. Chin, throat, belly, and under tail-coverts dull white,† chest pale grayish, sides and flanks deeper grayish, slightly tinged with brown. Bill black, feet dusky. Length (skin), 3.30; wing, 1.80; tail 1.05, middle feathers 0.10 shorter; exposed culmen, 0.65.

*Young male* (No. 84118, Mount Carmel, Illinois, August 17, 1870; R. Ridgway): Similar to the adult female, but upper parts less bronzy, the feathers indistinctly margined terminally with pale grayish buffy (observable only in certain lights); basal portion of tail-feathers much duller green. Lower parts as in adult female, but chin and throat narrowly streaked with brownish dusky, and sides and flanks more strongly tinged with buffy brown. Length (skin), 3.05; wing, 1.65; tail, 1.10, the middle feathers 0.95; exposed culmen, 0.65.

Young males begin to show the metallic-red feathers of the gorget the first winter or late during the first autumn, the tail at the same time remaining the same as described above. Some specimens have the dusky streaks on the throat broader than in the specimen described above, forming small oval or oblong spots instead of streaks.

In adult males there is little variation in color, except that the hue of the green above varies, as in other species, from a decided bronze to a clear bottle-green, the average tint being intermediate between the two, and the color always most decided on the upper tail-coverts and middle tail-feathers. The color of the throat is sometimes more scarlet (much the same as in *Selasphorus rufus*), and there is also some difference in the color of the lower parts, some specimens being darker than others.

In adult females there is the same variation in the color of the upper

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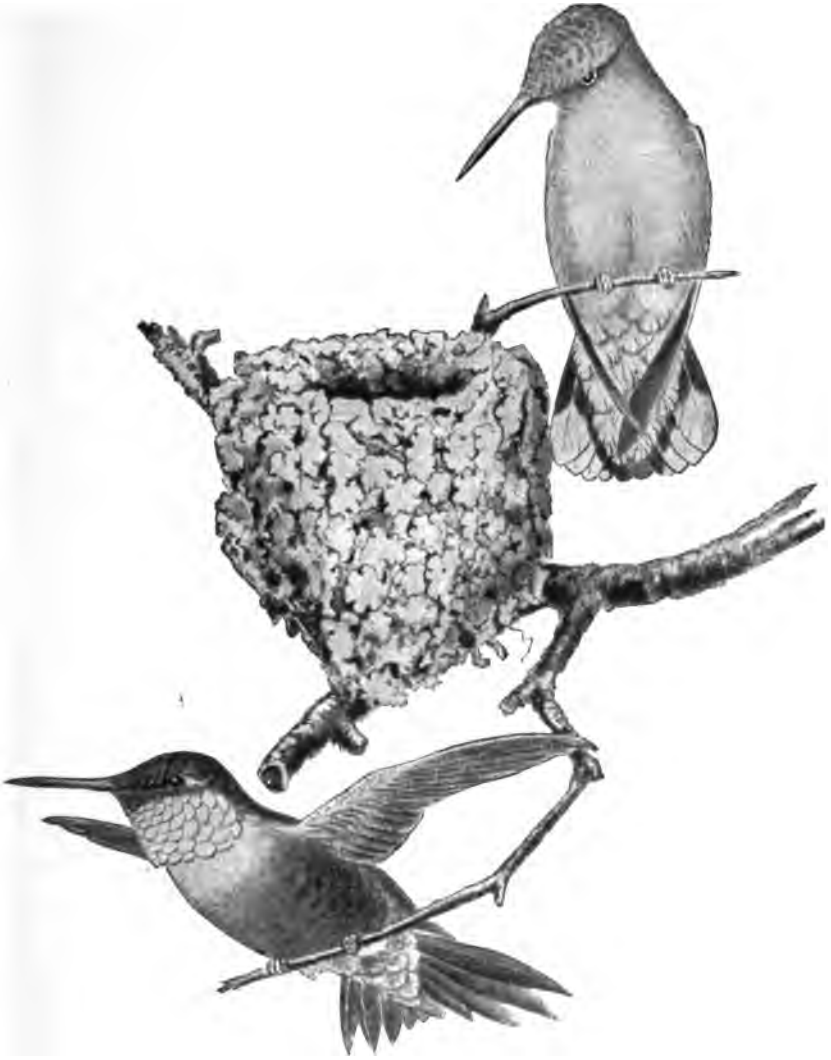
*The length of the adult male before skinning is about 3.50–3.75.

†In this particular specimen adventitiously stained with brown on chin and throat.



RUBY-THROATED HUMMING BIRD (*Trochilus colubris*).

**Male.** (Cat. No. 88130, U. S. N. M. Stamford, Connecticut. Collected and presented by Dr. R. W. Shufeldt, U. S. A.)

**Female.** (Cat. No. 29287, U. S. N. M. Xalapa, Mexico. Collected by R. Montes de Oca.)

**Nest.** (Cat. No. 23286, U. S. N. M. Sing Sing, New York. Collected and presented by Dr. A. K. Fisher.)

parts as in the male, and lower parts are more decidedly white in some specimens than in others; in others again, but chiefly (?) in autumnal birds, the flanks are more or less strongly tinged with rusty. Very rarely (?) is there any dusky streaking on the chin and upper throat, and never (?) is this so decided as is often seen in females of *T. alexandri.*

Little need be said as to the habits of this well-known Humming Bird. Its distribution is general over every portion of the continent from the Great Plains to the Atlantic coast and from Canada to the Gulf of Mexico. Arriving among us when spring is fairly established and departing just before the first autumnal frosts, these creatures traverse a distance in their migrations that appears almost impossible to creatures so minute, many individuals making their winter homes as far south as Veragua, in the State of New Granada, immediately north of the Isthmus of Panama. A considerable number pass the winter as far north as southern Florida, and a few have been seen during the same season in southern Texas.

The nest is a beautiful cup-shaped structure ornamented externally with a mosaic of bits of lichen and warmly lined with plant-down. The eggs average about 0.50 by 0.30 of an inch.

### VIOLET-THROATED HUMMING BIRD. *Trochilus violajugulum* JEFFRIES.

(Plate XXXVIII, Fig. 2.)

*Trochilus violajugulum* JEFFR., Auk, V, No. 2, April, 1888, 168; *ib.*, July, 1889, 223.

RANGE.—Southern California (vicinity of Santa Barbara).

SP. CHAR.—Most like *T. alexandri*, but larger, with gorget much more extensively metallic and much more reddish purple in color; tail much longer and more deeply forked, with outer feather relatively narrower and more pointed.

*Adult male* (No. 1616, coll. Dr. J. Amory Jeffries, Santa Barbara, California, May 4, 1883): Pileum dull dusky green—almost black when viewed from in front, more metallic from behind; rest of upper parts, except remiges and rectrices (but including middle pair of the latter), bronzy green; remiges and primary coverts dull purplish dusky; tail (except middle pair of feathers) dull black, the feathers tinged at tips with metallic green. A small white spot behind eye. Chin and a rather indistinct stripe thence backwarks beneath eye and along upper margin of gorget opaque dull black; gorget metallic, auricula purple* (much less violaceous than in *T. alexandri*), the posterior

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* See the author's Nomenclature of Colors (Little, Brown & Co., Boston), pl. VIII, fig. 3.

In describing the color of the gorget in Humming Birds some allowance should be made for individual variation. Taking a considerable number of specimens of four of the North American species (*Trochilus alexandri, Calypte costæ, Atthis heloisa*, and *Calothorax lucifer*), the color of the gorget varies so much that it is possible to find specimens of the four species which are so nearly alike in this respect that what little difference may exist can scarcely be described. The *average* difference, however, is very decided, and there is more difference in the degree of *brilliancy* of the surface and lateral feathers not lengthened; chest dull grayish white; rest of under parts dull light bronzy green, nearly uniform on sides and flanks, elsewhere broken by whitish margins to the feathers, these particularly distinct on the lower tail-coverts and along middle line of the belly. Bill black, feet dusky. Length (skin), 3.40; wing, 1.85; tail, 1.30; middle pair of rectrices 0.25 shorter, the lateral one only 0.15 wide in middle portion.*

Whether this bird represents a distinct species or a hybrid between *Trochilus alexandri* and *Calypte anna* or between the former and *Calothorax lucifer* can not now be determined; but there is very little, if anything, in the writer's opinion to give the hybrid theory any weight. In hybrids between species showing very obvious differences of form or coloration, the characters are invariably intermediate between those of the two parents; but only in the shape and coloration of the tail and coloration of the under parts do we see any approach to *C. anna* in those respects which distinguish the present bird from *T. alexandri.* Mr. Jeffries says that "the bird is roughly a *T. anna* without a crown-patch or ruff, and with violet [?] for sapphire [?].† The tail is of the same type as in *T. anna*, but smaller, and the angle spoken of‡ is less than 25° instead of 33°, so that in the closed tail the outer pair of feathers overlap instead of crossing as in *T. anna.*"

As to the shape of the lateral rectrices, which Dr. Jeffries compares with that of *C. anna*, I find on very careful comparison that there is no essential difference in this respect between *T. violajugulum* and *T. alexandri*, as the following diagrams (Fig. 47, page 331) will show:

The outer primary, instead of being narrow and slightly curved, as in *Calypte anna*, is broader (though perhaps not relatively so) than in *Trochilus alexandri*, and quite as strongly curved towards the tip.

After a very careful examination of the type, I am able to find a really striking or "suggestive" resemblance to *C. anna* only in the coloration of the under parts, which, except the gorget, is quite the same in the

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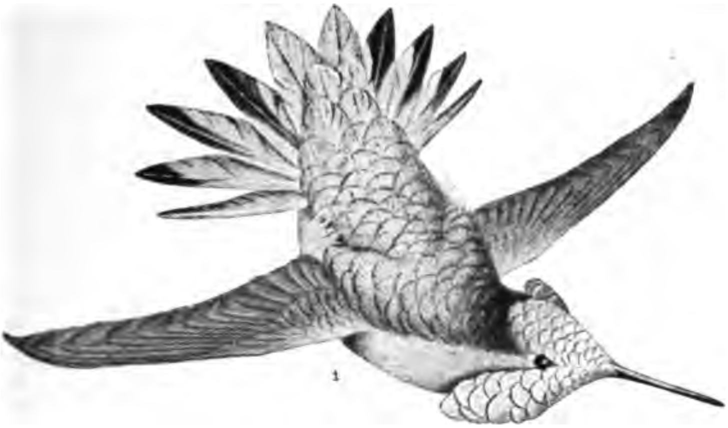
than in the color itself, while there are also characteristic differences in the variations of color depending on different positions as to the light. Thus *Atthis* has a distinct green reflection in a certain light, whereas *Calypte* and *Calothorax* in the same light show violet-blue. *T. alexandri* is much less brilliant and less changeable, but the individual variation is probably greater, the variation being from the normal violet through blue to a decided blue-green hue in some specimens, though such are rare. In *T. violajugulum* the gorget is a *redder* purple than in any of the preceding, nearly matching in color the gorget of some examples of *Stellula calliope*, though not quite so red.

*The tip of the bill having been shot away, the length of the culmen can not be given; the length of the bill from the base of the culmen to the tip of the lower mandible, however, is 0.68 of an inch.

† We should as little think of calling the color of the throat in *T. violajugulum* "violet" as we would the rich metallic purple-red of *C. anna* "sapphire."

‡ In Dr. Jeffries description of the outer pair of tail-feathers of *C. anna* these are said to be "abruptly narrow and linear shafts * * * forming, at the junction of the first and second third, an abrupt angle of 25°."



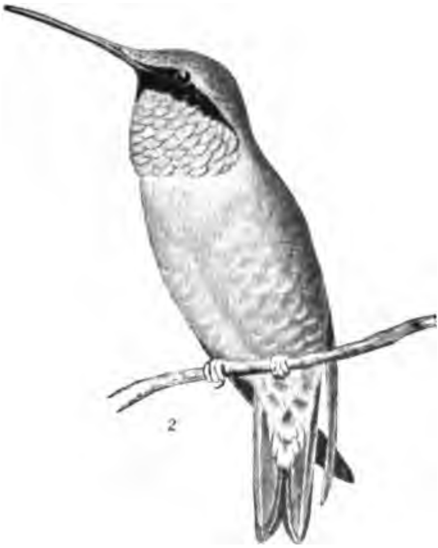


Fig. 1. FLORESI'S HUMMING BIRD (*Selasphorus floresii*) Gould. (From a specimen in the collection of Walter E. Bryant (No. 2620). San Francisco, California.)

Fig. 2. VIOLET-THROATED HUMMING BIRD (*Trochilus violajugulum*) Jeffries. (From the type, in the collection of Dr. J. Amory Jeffries, Boston, Massachusetts )

two birds; and it seems to me that, in the absence of structural characters, as well as those of coloration (further than the slight one noted), suggesting hybridism between *C. anna* or any other species, *T. violajugulum* may properly be regarded as a distinct species until more decided evidence to the contrary is obtained.

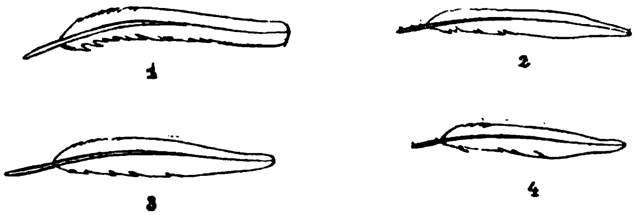


FIG. 47.—Outer tail feathers of (1) *Calypte anna*, (2) *Trochilus colubris*, (3) *T. violajuglum*, and (4) *T. alexandri*.

### BLACK-CHINNED HUMMING BIRD. *Trochilus alexandri* BOURC. and MULS.

*Trochilus alexandri* BOURC. and MULS., Ann. Soc. d'Agric. de Lyon, IX, 1846, 330.—CASS., Illustr. B. Cal. &c. I, 1854, 141, pl. 22.—GOULD, Mon. Troch. pt. XIV, 1857, pl. 4; vol. III, 1861, pl. 132.—COOPER, Orn. Cal. I, 1870, 353.—B. B. and R., Hist. N. Am. B. II, 1874, 450, pl. 47, fig. 1.
Alexandre's Humming Bird.
Purple-throated Humming Bird (GOULD, CASSIN).
L'Ornismye d'Alexandre (MULSANT and VERREAUX).
Chupamirto de pecho morado (D'OCA).

RANGE.—Western United States, between Rocky Mountains and Pacific coast; east to central Texas and Uintah Mountains, Utah; north to latitude 49°, in British Columbia, between Cascade and Rocky Mountains; breeding as far south as Guaymas, Sonora; wintering in western, central, and southern Mexico.

SP. CHAR.—*Adult male:* Chin and throat opaque velvety black, bordered below by a broad band of metallic violet, changing to green and blue; tail slightly forked or emarginated (depth of fork only about 0.10 of an inch); length about 3.30–3.75, wing 1.70–1.75, tail 1.20–1.25, culmen 0.70–0.75. *Adult female:* Tail much rounded, the middle feathers about the longest; plumage not essentially different from that of female *T. colubris*; length about 3.90–4.10, wing 1.90–2.00, tail 1.20–1.35, culmen .78–.90. *Young:* Similar to adult female; but feathers of upper parts margined terminally with light buffy or pale rusty, the male with throat streaked with dusky.

*Adult male* (No. 117256, Pinal County, Arizona, April 9, 1885; W. E. D. Scott): Above very dull bronze-green, the top of the head more dusky and quite destitute of metallic gloss on forehead; remiges dusky slate, slightly glossed with purple; rectrices (except middle pair) purplish black, margined terminally with dull bronze-green, this most extensive on lateral feathers. A small white spot behind eye. Chin, upper half of throat (for about .45 of an inch from point of chin), suborbital region, and ear-coverts, opaque velvety black; lower part of throat metallic violet, but slightly changeable, forming a transverse band about .22 of an inch wide; chest dull white; median line of breast and belly light grayish brown, the feathers margined with grayish white; sides and flanks dull bronze-green, the feathers narrowly margined with pale grayish or grayish white; under tail-coverts dull brownish bronze centrally, broadly margined with white. Bill and feet black. Length (skin), 3.40; wing, 1.72; tail, 1.20, the middle feathers 0.20 shorter; exposed culmen, 0.80.

*Adult female* (No. 117263, Pinal County, Arizona, April 14, 1885; W. E. D. Scott): Above dull metallic bronze-green, passing on top of head into dull grayish brown, the feathers with paler margins; remiges dull slate-dusky, glossed with purplish on the terminal portion. Middle pair of tail-feathers entirely bronze-green; rest bronze-green basally, then purplish black, the tip of the outer three white, the latter broadest on exterior feather, as is also the black; fourth feather with a small terminal spot of bronze-green. A small white spot behind eye; ear-coverts dull gray; chin, malar region and upper median portion of throat white; sides of throat, with chest and sides of neck, pale gray; median line of breast, whole belly, anal region, and under tail-coverts, white; sides and flanks white, tinged with pale grayish and light rufous. Bill and feet black. Length (skin), 3.65; wing, 2.00; tail, 1.20, middle feathers 0.08 shorter; exposed culmen, 0.90.

*Young male* (No. 117266, Pinal County, Arizona, July 8, 1884; W. E. D. Scott): Similar to streaked-throated adult females, but feathers of the upper parts distinctly margined with dull buff, and remiges without purplish gloss.

*Young female:* Not appreciably different from the young male.

In adult males there are the same general variations in color as are noticed under *T. colubris;* but the color of the lower throat varies much more than in that species, the variation being towards blue, some specimens showing even a green hue on at least the exposed portion of some of the feathers.

Adult females vary chiefly as to the chin and throat, which are usually plain white or grayish white, but frequently more or less distinctly streaked with dusky, even in spring and breeding specimens. Others, again, even breeding birds, have a distinct rusty tinge or suffusion on the flanks, as in *T. colubris.* Very rarely (as in No. 98440, Red Bluff, California, May 12, 1884, C. H. Townsend), the middle tail-feathers are blackish at their tips for a considerable distance.

While the range of this species within the United States is quite extensive, its distribution is irregular. According to Mr. Belding it is apparently rare or local in central California, although common along the Sacramento and San Joaquin Rivers, while it winters entirely south of that State, not having been met with by him during the winter even in the Cape district of Lower California. Mr. W. E. D. Scott* found it to be a "common summer resident in the Catalina Mountains, where it breeds very commonly. Arrives early in March, and is abundant by the last of that month. By the last of April the birds are mated and begin breeding; and I have found nests with fresh eggs late in July and early in August. By the 10th of October they have all left the region in question." He found it to be of uncommon occurrence above an altitude of 7,000 feet, but it was common and breeding at Fort Lowell, "which is north of Tucson and lies at about the same altitude," though about the latter place Mr. Herbert Brown regards it as rare, and has not found it breeding.

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* The Auk, Oct. 1886, p. 430.

The black-chinned Humming Bird has not yet been found as far to the eastward in the Rocky Mountain district as *Selasphorus platycercus* and *S. rufus*, the Uintah Mountains, Utah, being the easternmost limit recorded. In these mountains the present writer found it rather common in July, 1869, while it was also fairly common in the Wahsatch Mountains and in the vicinity of Salt Lake City.

It habits are essentially the same as those of the Ruby-throat.

### Genus **CALYPTE** Gould.

*Calypte* Gould, Introd. Troch. Oct. ed. 1861, 87. Type, *Ornismya costæ* Bourc.
*Leucaria* Mulsant, Cat. des Ois. Mouch. 1875, 29. Type, *Ornismya costæ* Bourc.

Generic Characters.—Adult males with the top of the head brilliantly metallic (red, purple, or violet), like the gorget, with its elongated lateral ruff-like extensions, and the tail emarginated or slightly forked, with the outer pair of feathers abruptly narrower than the rest (except in *C. helenæ*), and destitute of white or rufous markings; adult females with outer tail-feathers decidedly narrower than the next, but with broad rounded end, and without any rufous.

In this genus, or subgenus, the primaries are nearly intermediate in form between those of *Trochilus* and those of *Selasphorus*, though much more like the former. The males are very easily distinguished by the characters given above from those of both the other genera mentioned; but the females are so much like those of the species of *Trochilus* in both form and coloration that size alone is the easiest way to distinguish them—that of *C. costæ* being smaller, while that of *C. anna* is larger than the female of either species of *Trochilus*. From the females of any species of *Selasphorus*, as well as from that of *Atthis*, those of *Calypte* may be distinguished by the entire absence of any rufous on the tail.

Of the known species, two belong to California and northwestern Mexico and one to Cuba, the latter being aberrant in some parts of its structure as well as coloration, and perhaps entitled to subgeneric if not generic separation. It is the smallest of all Humming Birds, being considerably less than the Vervain Humming Bird of Jamaica and Hayti (*Mellisuga minima*), which hitherto has enjoyed the distinction of being least among birds.

The three species of *Calypte* may be distinguished by the following characters:

$a^1$. Wing not less than 1.70; upper tail-coverts and middle tail-feathers bronze-green; outer tail-feather of male much narrower than the next.

$b^1$. Tail 1.15 or more (1.30–1.45 in the male); *adult male* with gorget and top of head metallic purplish red; *adult female* dull light brownish gray beneath. *Hab.*: California, resident, a few migrating to Arizona and northern Mexico in winter. *C. anna* (LESS.). *Anna's Humming Bird.* (Page 334.)

$b^2$. Tail not more than 1.10 (still shorter in female); *adult male* with gorget and top of head metallic violet; *adult female* with under parts white. *Hab.*: Western Mexico, Arizona, Lower California, and southern California. *C. costæ* (BOURC.). *Costa's Humming Bird.* (Page 337.)

$a^2$. Wing not more than 1.15; upper tail-coverts and middle tail-feathers metallic blue or greenish-blue; outer tail-feather of male not narrower than the next. *Adult male* with gorget and top of head metallic purplish red (as in *C. anna*); *adult female* with anterior half of lower parts pale ash-gray, posterior half white. *Hab.*: Cuba. *C. helenæ* (GUNDL.). *Princess Helena's Humming Bird.*[*]

ANNA'S HUMMING BIRD. *Calypte anna* (LESS.).

*Ornismya anna* LESS., Ois. Mouch., 1829, 205, pl. 74.

*Trochilus anna* JARD., Nat. Libr. Humming B., I, 1833, 93, pl. 6.—AUD., Orn. Biog. V, 1839, 438, pl. 425; Synop. 1839, 170; B. Am. IV, 1842, 188, pl. 252.

*Calypte annæ* GOULD, Mon. Troch., pt. XI, 1856, pl. 5; vol. III, 1861, pl. 135.—COOP. Orn. Cal. I, 1870, 358.—B. B. and R., Hist. N. Am. B. II, 1874, 454, pl. 47, fig. 7.

Red-headed Humming Bird.
Anna's Calypte (GOULD).
Chupamirto de cabeza y cuello escarlata (D'OCA).
Le Calypte d'Anna (MULSANT and VERREAUX).
Oiseau-Mouche Anna (LESSON).

RANGE.—California, resident in warmer portions; performs a partial migration south through Arizona to table-lands of Mexico; south in Lower California as far as Cerros Island.

SP. CHAR.—*Adult male:* Entire head (except occiput), including ruff, brilliantly metallic purplish red; length about 3.40–3.75, wing 1.90–2.00, tail 1.30–145, exposed culmen 0.65–0.70. *Adult female:* bronze-green above, including top of head, the latter sometimes dull grayish brown, with little if any metallic gloss; throat pale gray or grayish white, the feathers with darker central spots, often mixed with spots of metallic crimson; length 3.80–4.15, wing 2.00–2.05, tail 1.15–1.30, exposed culmen 0.70–0.75.

*Adult male* (No. 84123, Marin County, California, February 15, 1877; C. A. Allen): Entire head (except occiput), including gorget, with its elongated latero-posterior feathers, forehead, crown, and post-ocular region, rich, brilliant, metallic purplish red, or rose-red, with more purplish, and in certain lights somewhat golden or bronzy, reflections; occiput, hind neck, back, scapulars, wing-coverts, rump, upper tail-coverts, and middle pair of tail-feathers metallic bronze-green; remiges dusky, with very faint purplish gloss; tail-feathers (except middle pair) dull purplish black, with inner webs chiefly pale brownish gray, the pair next to the middle ones strongly tinged or washed with metallic green. A minute white spot immediately behind eye. Chest pale brownish gray, the feathers with still paler (grayish white) terminal margins; sides and flanks rather dull metallic bronze-green, inclining to olive in some lights, the feathers indistinctly margined with pale brownish gray; median line of breast and belly similar, but paler on account of greater width of the pale grayish margins; downy tufts between rump and flanks pure white; under tail-coverts white with a central longitudinal space of grayish olive glossed with green. Bill and feet black. Length (skin), 3.75, wing 2.00, tail 1.40 (middle feathers 0.25 shorter), exposed culmen, 0.68.

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[*] *Orthorhynchus helenæ* GUNDL. LEMB., Aves de la Isla de Cuba, 1850, 70, pl. 10, fig. 2.—*Calypte helenæ* GOULD, Mon. Troch. III, pl. 136.

*Adult female* (No. 6052, San Francisco, California, winter 1853–'54; Dr. R. D. Cutts): Whole top of head metallic bronze-green, less bright than the back and becoming much duller on forehead; upper parts otherwise as in the male, except three outer tail-feathers, the first of which is dull brownish white at tip (for about 0.25 of an inch on outer web), then black (for about 0.30 of an inch), the basal portion light grayish brown; second feather with whitish tip smaller and black subterminal space larger, the basal portion chiefly metallic green; third with only a very narrow terminal edging of white, but otherwise like the second; fourth with merely a blackish spot near tip of each web, on edge, that on outer web reaching almost to the shaft. Lower parts as in the male, but malar region, chin, and throat pale brownish gray, the middle of the latter spotted with metallic red, the ear-coverts grayish brown. Bill and feet black. Length (skin), 3.80; wing, 2.05; tail, 1.15 (the outer feathers 0.05 shorter); exposed culmen, 0.70.

*Young male:* Similar to the adult female, but tail different, the whitish tips and blackish subterminal spaces of the two outer feathers being much less distinct. Autumnal specimens show metallic red feathers, mixed with the first plumage, on crown and throat.

*Young female* (No. 79671, Tejon Mountains, California, August 19, 1875; H. W. Henshaw): Similar to the adult female, but feathers of upper parts, particularly on those of rump and the upper tail-coverts, very narrowly margined at tips with pale grayish buffy.

Adult males vary somewhat in the color of the crown and throat, some being more purplish red than others. One (No. 5501, Petaluma, California, E. Samuels), has the crown glossed with steel-blue in certain lights.

Females with metallic feathers on the throat seem to be the rule rather than the exception in this species; at least, of the 11 specimens now before me, 8 have the throat thus ornamented, though the extent of the metallic red spotting varies greatly.

Perhaps the most beautiful of North American Humming Birds, this species, named by M. Lesson after Mme. Anna, Duchesse de

Rivoli, is one of the most abundant of those occurring in the State of California, where it remains throughout the year. Its distribution within that State is pretty general, though it is said to be much less frequent in the low valleys than in the mountains in summer, probably on account of the comparative scarcity of flowers. At San Diego it is said to be more numerous in winter than in summer, as is probably the case in other parts of southern California. Mr. Belding did not find it in Lower California farther south than Cerros Island, where he took a single specimen in April. Those individuals which pass beyond the United States during their winter migration appear to go to northern Mexico by way of Arizona, Mr. Henshaw having found it common in the vicinity of Camp Grant from September 24 to 27, 1873. Mr. Scott, however, found it so rare in that Territory that he met with but a single specimen, which he took on October 1, 1883, in the Catalina Mountains, at an altitude of 5,000 feet, and he says* that Mr. Herbert Brown has no record of its occurrence about Tucson at any season.

At the place where Mr. Henshaw found them they were "by no means rare," as he saw in the neighborhood of 20 during the four days which he spent in collecting there. "They were always seen in the immediate vicinity of the creeks, where only at this late season there remained a few of the bright flowers about which they were seen hovering. Their large size rendered them very conspicuous among the other species, and as if aware of this they were much the shyest of all."†

I have referred above to the beauty of this species, a fact which seems to have impressed Mr. Gould also, judging from the following, from Vol. III of his Monograph of the Trochilidæ (p. 135):

> When studying the diversified forms and coloring of the Trochilidæ, I have frequently been struck with the fact that those districts or countries having a metalliferous character are tenanted by species of Humming Birds which are more than ordinarily brilliant and glittering. This is especially the case with the species inhabiting Mexico and California: in illustration of this assertion, I may cite the three California species, *Selasphorus rufus*, *Calypte costæ*, and the present bird, *C. annæ*, all of which are unequaled for the rich metallic brilliancy of certain parts of their plumage, by any other members of the family. The two latter, *C. costæ* and *C. annæ*. have not only the throat, but the entire head as glitteringly resplendent as if they had been dipped in molten metal.

For a very interesting account of the nesting habits of *Calypte anna*, the reader is referred to an article, headed "Notes from California," in the Ornithologist and Oologist, Vol. VII, p. 139.

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* The Auk, October, 1886, p. 431.

† Report on Ornithological Specimens, Wheeler's Exp., 1873, pp. 130, 131.

### COSTA'S HUMMING BIRD. *Calypte costæ* (BOURC.).

(Plate XXXIX.)

*Ornismya costæ* BOURC., Rev. Zool. 1839, 294.

*Calypte costæ* GOULD, Mon. Troch. pt. XI, 1856, pl. 7; vol. III, 1861, pl. 134.—COOP., Orn. Cal. I, 1870, 360.—B. B. and R., Hist. N. Am. B. II, 1874, 457, pl. 47, fig. 8.

Costa's Calypte (GOULD).

La Leucaire de Costa (MULSANT and VERREAUX).

Oiseau-Mouche de Costa (BOURCIER).

Chupamirto de gola y cabeza violada (D'OCA).

RANGE.—Southern California, Lower California, Arizona, and western Mexico.

SP. CHAR.—*Adult male* with top of head, gorget and ruff brilliantly burnished metallic violet, changing to royal purple, blue, and sometimes even to green in certain lights; length about 2.75–3.20, wing 1.75–1.90, tail about 1.10, exposed culmen, 0.65–0.68. *Adult female* with top of head dull grayish brown anteriorly, changing to bronze or bronze-green posteriorly, like color of back, etc.; chin and throat grayish white, sometimes spotted with metallic violet; basal portion of lateral tail-feather pale grayish brown; length about 3.55–3.70, wing 1.70–1.80, tail 1.05, exposed culmen 0.65–0.70.

*Adult male* (No. 99215, Tucson, Arizona, March 18, 1884; E. W. Nelson): Whole top of head, chin, throat, ear-coverts and much elongated feathers (extending nearly 1 inch from chin-angle) on side of throat richly burnished metallic violet, changing to royal purple and blue in different lights; rest of upper parts, except remiges, bronze-green; remiges dusky slate, faintly glossed with purplish; tail (except middle pair of feathers) grayish dusky glossed with green, this more distinct toward middle feathers, the inner web of outer feather considerably paler, and the three outer feathers darker near tip. A small white spot behind eye. Lower foreneck and chest white; sides and flanks deep metallic bronze green; median line of breast and belly pale grayish or dull grayish white; silky tufts between rump and flanks, pure white; under tail-coverts bronze-green centrally, white around margins. Bill and feet black. Length (skin) 3.15, wing 1.75, tail 1.05, middle feathers 0.15 shorter, exposed culmen 0.68.

*Adult female* (No. 99216, Tucson, Arizona, May, 1884; E. W. Nelson): Top of head dull light brownish gray, passing on occiput into dull metallic bronze-green and this into lighter bronze-green on back, scapulars, wing-coverts, rump, upper tail-coverts, and middle pair of tail-feathers; the feathers of the back, etc., showing, in certain lights, very indistinct terminal margins of pale buffy grayish; remiges dull brownish slate, very faintly glossed with purplish; rectrices next to middle pair metallic bronze-green, broadly tipped with black; next pair similar, but black much more extensive and the tip white (for about .05 of an inch); next pair with white tip much wider, and the basal portion green only next to the black band, the remaining part pale brownish gray; outer pair similar but with basal portion wholly pale brownish gray, and the white tip slightly longer (extending about .20 of an inch from tip). A small white spot behind eye; beneath this an oblique patch of brownish gray, extending from lower eyelid across ear-coverts and gradually fading into the white of the throat; chin, throat, breast, belly, and under tail-coverts dull white; feathers of sides and flanks pale bronze-green, broadly margined with pale buffy grayish or brownish white. Bill and feet black. Length (skin) 3, wing 1.80, tail 0.95 (outer feathers 0.10 shorter), exposed culmen 0.65.

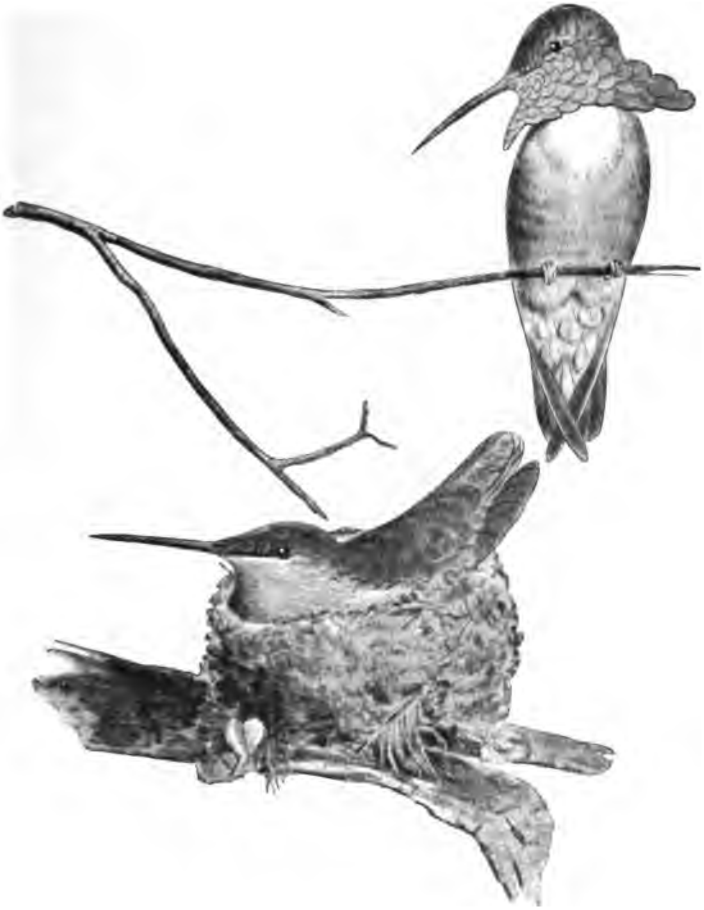
*Young male* (No. 99369, Santa Rita Mountains, Arizona; E. W. Nelson): Much like the adult female, as described above, but top of head dull, faintly metallic, bronze-green, like back, etc., and all the feathers of upper surface of head and body distinctly margined terminally with pale grayish buff, this most conspicuous on rump; rectrices with both the white tips and black subterminal spaces less extensive, and basal portion of outer feathers faintly glossed with green; oblique patch from beneath eye and across ear-coverts much darker; posterior part of sides of throat spotted with dusky grayish brown, the more anterior portion and chin marked with much smaller and paler spots; middle of throat metallic violet.

*Young female* (No. 117281, Pinal County, Arizona, May 27, 1885; W. E. D. Scott): Like the young male, as described, but entire throat, with chin, immaculate white, shading into pale brownish gray on sides of neck; forehead and crown pale brownish gray, the feathers with small central spots of darker; tail much as in adult female.

Adult males vary somewhat in the changeable reflections of the crown and ruff, which usually varies from a pure magenta or aster purple, through violet, to light steel-blue, with occasional greenish tints, according to the position in which the bird is held, some specimens showing the blue and green reflections more strongly than others. In one example, a "mummied" skin from San Quentin Bay, Lower California (No. 96615, May 9, 1880, L. Belding), a portion of the crown and the tips of some of the ruff feathers are permanently or unchangeably bright green; but possibly this may be the result of contact with the carbolic acid with which the specimen was preserved. There is also a good deal of variation in the distinctness of the markings on the under tail-coverts, some specimens having the central portions of these feathers very faint grayish, others very deep bronze or bronze green.

Some adult females show metallic violet, bluish, or bluish green feathers on the middle of the throat, but usually these are altogether absent.

This beautiful Humming Bird, named by M. Bourcier in honor of M. le Marquis Costa de Beauregard, is also an inhabitant of California, but unlike *C. anna* is of very limited distribution in that State. According to Dr. Cooper it has been taken as far north as San Francisco, but it is probably only a straggler there, and it is said to be very rare in Ventura County. It is common during summer in the cañons of the San



COSTA'S HUMMING BIRD (*Calypte costæ*).

**Male.** (Cat. No. 117272, U. S. N. M. Pinal County, Arizona. Collected by W. E. D. Scott.)

**Female.** (Cat. No. 117272, U. S. N. M. La Paz, Lower California. Collected and presented by L. Belding.)

Nest. (Cat. No. 18542, U. S. N. M. La Paz, Lower California. Collected and presented by L. Belding.)

Bernardino foot-hills, and breeds also on the Colorado Desert, where its nest was found by Mr. F. Stephens as early as March 18. It winters abundantly in the Cape district of Lower California, but none are said to winter so far north as San Diego. It breeds in the Cape district, but is much less common there in summer than in winter. In southern Arizona it occurs abundantly during its migrations, and also breeds in those localities, which seem specially adapted to it.

Says Mr. W. E. D. Scott*:

> In 1884 I did not meet with the birds in the Catalinas till late in July, and then only sparingly. But in 1885, in the same locality, the birds were very common by April 5, particularly the males, in the most gorgeous plumage. The absence of adult females for the next six weeks was very noticeable. I think I took only three, though the males were common all the time. About the 20th of May young birds of the year began to be abundant, and adult birds of either sex were diffiult to find. The young birds were common all through June; I could often count twenty near my house; but after June 1 I was unable to get any adult birds of either sex. I do not think the birds bred in the Catalinas, but think that probably they did breed in numbers on the San Pedro River.

Two nests of this species, collected at La Paz, by Mr. Belding, are quite different in size and shape. Both are ordinary looking structures, composed of dull gray lichens and small pieces of thin bark, held together with spiders' webs, the interior containing a few soft small feathers, in one nest apparently of the summer yellow bird (*Dendroica æstiva*). The larger nest measures about 1½ inches in diameter by a little more than 1 inch in depth, the cavity being about 0.1 by 0.80; the smaller one measures about the same in diameter across the top, but is much narrower at the bottom, is less than 1 inch high, and has a shallower cavity with much thinner walls. Each contains a single egg, one measuring 0.30 by 0.50, the other 0.32 by 0.50. The identification is positive, the parent bird accompanying each nest. One of these females has a very large spot or patch of metallic violet on the throat, while the other has instead only a few dusky specks.

### GENUS **SELASPHORUS** SWAINSON.

*Selasphorus* SWAINS., Fauna Bor.-Am. II. 1831, 324, and 496. Type, *Trochilus rufus* GMEL.

GENERIC CHARACTERS.—*Adult males* with the tail-feathers partly rufous, the outer primary narrow and pointed (except in three of the Central American species†), and the tail more or less graduated, with some of the feathers, at least, more or less pointed; top of head greenish, or at least not similar in color to the gorget (except in *S. floresii*).

The species of this genus, or subgenus, differ so much among themselves in points of structure that I am not able to give any better diagnosis than the above. The typical species are easily recognized, so far as the males are concerned, by the narrow and pointed outer primary, all of the northern species possessing this character, while one of the southern species (*S. scintilla*) does also; while as to coloration, the males of all are characterized by a greater or less amount of rufous, *longitudinally* disposed, on at least some of the tail-feathers. The tail is more or less graduated or wedge-shaped, except in *S. platycercus*, in which six middle feathers are about equal in length, the two outer pairs, successively, decidedly shorter. All have a more or less brilliant metallic gorget, which in all of the species except *S. platycercus* has the postero-lateral feathers elongated into a conspicuous "ruff." Only *S. floresii* has the top of the head brilliantly metallic (the same color as the throat), thus showing an affinity to the genus or subgenus *Calypte*, which, however, has an emarginate and differently colored tail and very differently shaped outer primary.

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*The Auk, Oct., 1886, p. 431.

† *S. torridus* SALV., *S. ardens* SALV., and *S. flammula* SALV., have the tip of the outer primary rounded.

It is very difficult to recognize generic or subgeneric characters in the females; but their more graduated tails, with a considerable quantity of rufous on the basal portion of at least three of the rectrices, will distinguish them from the females of any other North American Humming Birds, except *Stellula calliope*, which has the rufous much more restricted as well as paler and duller, and the six middle feathers of somewhat spatulate or pandurate form; and from those of any Mexican genera except *Atthis*, *Doricha*, and *Calothorax*, which, except the first, differ in having a curved bill and short middle tail-feathers.

The female of *Atthis heloisa* is essentially similar to that of some species of *Selasphorus* in the coloration of the tail, but the latter is double-rounded, and the outer primary is much broader.

The known species of *Selasphorus* may be distinguished as follows:

### MALES.

a¹. Top of the head brilliant metallic red, like the gorget. *Hab.*: Western Mexico; San Francisco, Cal.?
*S. floresii* GOULD. *Floresi's Humming Bird.* (Page 341.)

a¹. Top of the head greenish, totally different from the color of the gorget.

  b¹. Middle tail-feathers rufous, with a median streak or stripe of black; gorget brilliant fire-red or metallic scarlet.

    c¹. Upper parts (except top of head) rufous, sometimes glossed with green on the back. *Hab.*: Western North America south to Mexico.
    *S. rufus* GMEL. *Rufous Humming Bird.* (Page 343.)

    c². Upper parts mainly metallic green.

      d¹. Larger (like (*S. rufus*), with upper tail-coverts wholly rufous. *Hab.*: British Columbia to Arizona. *S. alleni* HENSH. *Allen's Humming Bird.* (Page 347.)

      d². Smaller (wing only 1.30, culmen less than .50), with upper tail-coverts partly green. *Hab.*: Costa Rica and Veragua.
      *S. scintilla* GOULD. *Sparkling Humming Bird.*[*]

  b². Middle tail-feathers merely edged with rufous or (in *S. platycercus*) with no rufous whatever.

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[*] *Trochilus* (*Selasphorus*) *scintilla* GOULD, P. Z. S., 1850, 162.

*c*¹. Middle tail-feathers edged with rufous; outer primary not attenuated at tip.

*d*¹. Middle tail-feathers purplish black with little or no metallic green, this, if present, on outer web only and not extending nearly to the shaft. (Gorget metallic "pomegranate-purple," not very brilliant.) HAB. Veragua and Costa Rica. *S. ardens* Salv. *Blazing Humming Bird.**

*d*². Middle tail-feathers, metallic green, the inner web (only) sometimes partly purplish black.

*e*¹. Gorget dull "heliotrope-purple," or dull grayish purple, with silvery or even greenish reflections. HAB. Veragua. *S. torridus* SALV. *Parched Humming Bird.*†

*e*². Gorget dull lilac-purple or wine-purple. HAB. Costa Rica and Veragua. *S. flammula* SALV. *Flaming Humming Bird.*‡

*c*². Middle tail-feathers metallic green, without rufous edgings; outer primary attenuated and curved outward at tip; wing, 1.85 or more. (Gorget rose-purple or solferino.) HAB. Rocky Mountain district, south to Guatemala. *S. platycercus* (SWAINS.) *Broad-tailed Humming Bird.* (Page 350.)

FEMALES.

*a*¹. Outer tail-feathers tipped with white.

*b*¹. Wing not less than 1.65.

*c*². Wing more than 1.90 (2.00–2.10), middle tail feathers without any rufous, and next feather with merely a slight edging of this color if any. *S. platycercus.*

*c*². Wing less than 1.90; middle tail-feathers with more or less of rufous on basal portion, the next feather with basal half or more rufous.

*d*¹. Outer tail-feather about .15 wide across middle of black space; wing 1.75–1.80. *S. rufus.*

*d*². Outer tail-feather only .10 wide across middle of black space; wing 1.65–1.70. *S. alleni.*

*b*². Wing less than 1.65. *S. torridus.*

*a*². Outer tail-feathers tipped with light cinnamon-rufous or ochraceous-buff.

*b*¹. Middle tail-feathers margined on both webs with cinnamon-rufous; outer tail-feathers with both webs rufous at base.

*c*¹. All the tail-feathers except middle pair cinnamon-rufous across both webs at base. *S. scintilla.*

*c*². Only three outer tail-feathers cinnamon-rufous across both webs at base. *S. ardens.*

*b*². Middle tail-feather with only the outer web margined with cinnamon-rufous; outer tail-feather with only the inner web rufous at base. *S. flammula.*

## FLORESI'S HUMMING BIRD. *Selasphorus rubromitratus* RIDGW.

(Plate XXXVIII, Fig. 1.)

*Selasphorus floresii* GOULD, Mon. Troch. pt. XXIII, Sept. 1, 1861, pl. 10; vol. III, 1861, pl. 139 (*nec Trochilus floresii* BOURC., Rev. Zoöl. 1846, 316).—BRYANT, Forest and Stream, XXVI, No. 22, July 24, 1886, 426 (San Francisco, Cal.).

*Trochilus floresii* GRAY, Hand., l. I, 1869, 144 (Subgen. *Selasphorus*).—RIDGW.-Man. N. Am. B. 1887, 315.—A. O. U., Abridged Check List, 1889, No. 431.1.

*Trochilus rubromitratus* and *Selasphorus rubromitratus*, RIDGW., Auk. VIII, Jan., 1891, 114.

Le Sélasphore de Floresi (MULSANT and VERREAUX).

Chupamirto de corona y pecho escarlata (D'OCA).

Floresi's Flame-bearer (GOULD).

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* *Selasphorus ardens* SALV., P. Z. S. 1870, 209.

† *Selasphorus torridus* SALV., P. Z. S. 1870, 208.

‡ *Selasphorus flammula* SALV., P. Z. S. 1864, 586.

**RANGE.**—Southwestern Mexico (Bolanos, State of Oaxaca); accidental near San Francisco, California.

**SP. CHAR.**—*Adult male* similar in color to *Calypte anna*, but red of the head more scarlet, and tail-feathers largely rufous-chestnut; outer primary much narrower than in *C. anna*, and tail of very different shape, the lateral pair of rectrices being much shorter than the middle pair, instead of the reverse.

*Adult male* (No. 2620, coll. Walter E. Bryant, San Francisco, California): Whole top of head, except occiput, together with entire chin and throat, including the elongated postero-lateral feathers of the gorget, intense, glowing metallic rose-red, changing to metallic scarlet, especially on chin and upper part of throat; occiput, hind neck, back, scapulars, wing-coverts, rump, and upper tail-coverts metallic bronze-green; remiges dusky, or dull brownish slate, faintly glossed with purplish; middle pair of tail-feathers metallic green (much less bronzy than back, etc.), the outer web broadly edged with rufous-chestnut nearly to the tip, the inner web similarly marked for basal half; next feather chestnut-rufous with a median stripe of purplish-black, this stripe gradually coming to a point before the base of the feather is reached, but in the other direction widening so as to reach the edge of each web about .25 of an inch from the tip; next feather similar, but the black occupying whole width of outer web to a distance of half an inch from the tip, but much restricted on inner web; next feather with the black extending about as far along the edge of the outer web, but not reaching further along the shaft, while on the inner web it follows the shaft no further than .20 of an inch from the tip; outer feather dusky, with shaft chestnut-rufous nearly to the tip and inner web a paler tint of the same for about the basal half. Chest pale brownish gray, paler anteriorly against the lower margin of the metallic gorget; middle line of breast and belly similar; sides and flanks metallic bronze-green, the feathers margined with pale brownish gray; axillars and adjacent smaller under wing-coverts, light chestnut or cinnamon-rufous; femoral downy tufts white; under tail-coverts pale cinnamon-rufous, becoming grayish white on latero-basal portion. Bill, black. Wing, 1.70. Tail, middle feathers 1.00, longest feathers (third pair) 1.20, shortest feather (outer pair) 0.95,* exposed culmen 0.65.

The adult male described above agrees exactly with Mr. Gould's description and colored figures except in some minor and unessential points, and since Mr. Gould's description and figures, though from the same specimen, do not agree with one another, it is altogether likely that neither is quite correct. Mr. Gould describes the color of the middle pair of tail-feathers as "green with purple reflexions," and the lateral ones as having the outer webs "purple" and the "inner webs deep reddish buff," but they are not so colored in the plate, which represents the middle pair as green with a continuous broad border of rufous, and the outer pair as uniform purplish dusky, the intermediate feathers being rufous with a narrow median stripe of purplish dusky, expanding into a wedge-shaped space near the tip. The coloration of the tail as represented in the plate agrees very well with that of the San Francisco specimen, except that the latter has the basal half of the inner web of the outer tail-feathers rufous, and lacks the rufous border around the end of the middle feathers, the rufous running out to the edge a little past the middle of the feather, and thus confined to a little more than the basal half.

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* The tail being widely spread, these measurements may not be more than approximately correct.

This most beautiful Humming Bird is so rare that only two examples have been recorded, while the female is unknown. The history of the type-specimen is thus told by Mr. Gould:

> One of the very finest birds in the Loddigesian Collection was presented to the late Mr. George Loddiges by Mr. Floresi. The specimen is in the best state of preservation, and the bird must have been killed immediately after its moulting had been completed, when its plumage was in its greatest beauty. It would, indeed, be most difficult, if not impossible, to represent the color of the head and throat by any artistic means at our command. In brilliancy it fully equals that of the freshly moulted males of *Selasphorus rufus*, but differs from that and all the other known species of the genus in having the entire crown, as well as the gorget, of the brightest flame color. In the form and coloring of its tail it is a true *Selasphorus* while the disposition of the colors of the body allies it to *Calypte*.
>
> I have been kindly permitted by Miss Loddiges to take a drawing of the bird, and that lady has also placed in my hands the following note made by her father in reference to this species:
>
> "August 11, 1845. Mr. Floresi sent me a most beautiful Humming Bird, which I call *Floresii*. It is from Bolanos, and is nearly allied to *Anna*, but is much more brightly colored; viewed in front, it is scarlet, the sides of the collar are ruby color or crimson, the head is bright ruby color, and the tail is something like that of *platycercus*, but has brown inner webs. Mr. Floresi says it is the only one he has ever seen.

The specimen which I have described above was discovered in a taxidermist's shop in San Francisco, California, in 1885, by Mr. Walter E. Bryant, of that city, to whom I am indebted for the pleasure of inspecting it. It had been mounted as a "hat bird," and the taxidermist who stuffed it assured Mr. Bryant that the specimen had been killed in the vicinity of the city. (See Forest and Stream, vol. XXVI, p. 426.)

### RUFOUS HUMMING BIRD. *Selasphorus rufus* (GMEL.).

(Plate XL.)

*Trochilus rufus* GMEL., S. N. i, 1788, 497.—AUD., Orn. Biog. IV, 1838, 555.—NUTT., Man. 2d ed. I, 1840, 714.

*Trochilus* (*Selasphorus*) *rufus* SWAINS., F. B.-A. II, 1831, 324.

*Selasphorus rufus* AUD., Synop. 1839, 171; B. Am. IV, 1842, 200, pl. 254.—GOULD, Mon. Troch. pt. III, 1854, pl. 5 (part); vol. III, 1861, pl. 141 (part).—COOP., Orn. Cal. I, 1870, 355.—B. B. and R., Hist. N. Am. B. II, 1874, 459, pl. 47, fig. 4.

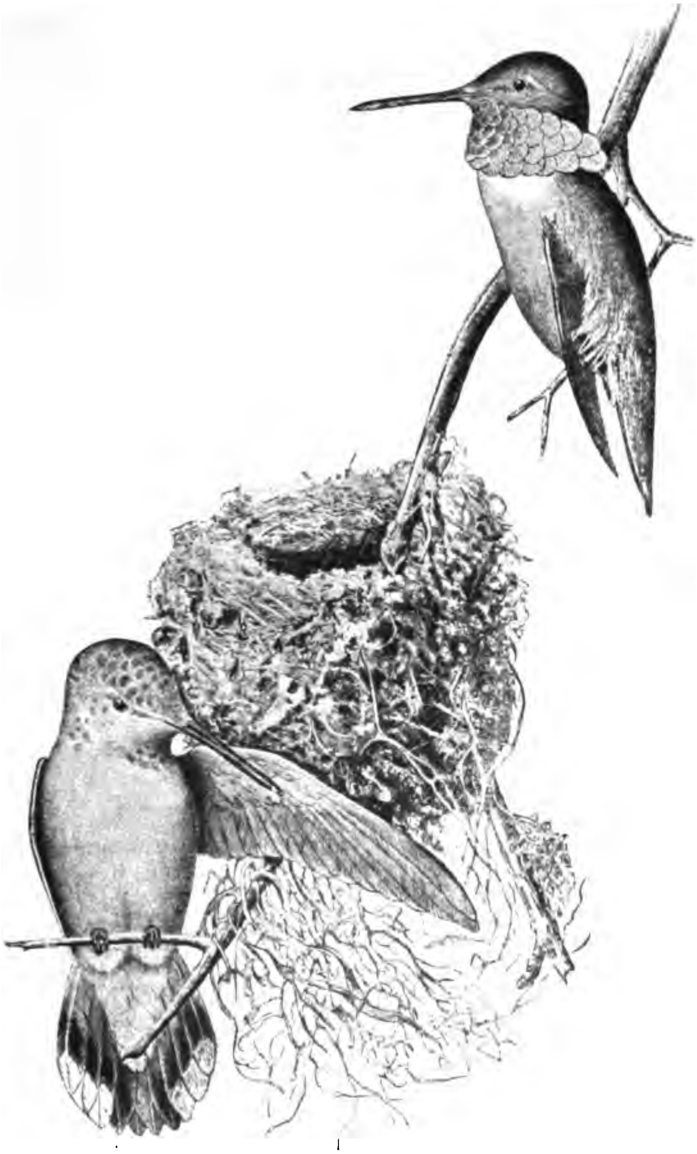
*Selasphorus henshawi* ELLIOT, Bull. Nutt. Orn. Club, II, Oct. 1877, 97, 102; Class. and Synop. Troch. 1879, 111.

Nootka Sound Humming Bird.
Ruff-necked Humming Bird (LATHAM, AUDUBON).
Ruff-necked Honey-sucker (PENNANT).
Cinnamon, or Nootka Humming Bird (SWAINSON).
Rufous-backed Humming Bird.
Rufous Flame-bearer (GOULD).
Le Sélasphore sasin (MULSANT and VERREAUX).
Chupamirto pecho dorado (D'OCA).

RANGE.—Western North America, breeding from the higher mountains of southern California northward, near the coast, to Nootka Sound, Alaska; during migrations, east to Montana, Colorado, New Mexico, and western Texas; wintering on table-lands of Mexico.

SP. CHAR.—*Adult* male with the upper parts, except top of head and wing-coverts, deep cinnamon-rufous or brick-color, the back sometimes washed with green but never continuously of this color; top of head dull bronze or bronzy green; gorget intensely brilliant metallic scarlet, changing to golden in certain lights; chest white, the remaining under parts light cinnamon-rufous, paler along median line. Tail-feather next to middle pair with a notch near end of inner web, the outer web sinuated near tip; outer tail-feather more than 0.10 of an inch wide; length, about 3.25–3.70; wing, 1.50–1.60; tail, 1.30–1.35; exposed culmen, 0.60–0.65. *Adult female*, bronze-green above; all the tail-feathers, including middle pair, cinnamon-rufous basally, the three outer broadly tipped with white and crossed by a broad subterminal band of black; terminal or subterminal portion of fourth feather also black, the white tip, if present, very small; outer feather more than 0.10 of an inch wide; chin, throat, chest, and median portion of breast white, other lower parts pale cinnamon-rufous; throat usually spotted with metallic scarlet or golden red, often with a considerable patch of this color; length, about 3.50–3.90; wing, 1.75–1.80; tail, 1.12–1.30; exposed culmen, 0.65–0.72.

*Adult male* (No. 2896, Columbia River, Oregon, May, 1835; J. K. Townsend): Forehead and crown dull bronze, without greenish tinge; wing-coverts greenish bronze; remiges dusky, or dull brownish slate, very faintly glossed with purplish; rest of upper parts uniform deep cinnamon-rufous, without a trace of green; rectrices with a broad median streak of purplish dusky on the terminal portion (this streak about .45 of an inch long on middle feathers), but on two outer feathers this dusky color confined to outer webs. A small white spot immediately behind eye. Lores, suborbital region, and ear-coverts light cinnamon-rufous. Chin and entire throat, including the elongated postero-lateral feathers or "ruff," intensely brilliant metallic scarlet, more purplish, or ruby, red in some lights, golden red in others; chest white; rest of lower parts light cinnamon-rufous, deeper on sides and flanks; downy tufts between rump and flanks white, tinged with rufous. Bill and feet black. Length (skin), 3.40; wing, 1.50; tail, 1.20, lateral feathers, 0.30 shorter; exposed culmen, 0.62.



RUFOUS HUMMING BIRD (*Selasphorus rufus*).

**Male.** (Cat. No. 91741, U. S. N. M. Baird, California. Collected by Charles H. Townsend.)

**Female.** (Cat. No. 94678, U. S. N. M. Santa Fé Mountains, New Mexico. Collected by H. W. Henshaw.)

Nest. (Cat. No. 3026, U. S. N. M. Port Townsend, Washington. Collected by J. G. Swan.)

*Adult female* (No. 1943, Columbia River, Oregon, May 29, 1835; J. K. Townsend): Above bronze-green, becoming dull grayish brown, very faintly glossed with bronze-green, on forehead and crown; upper tail coverts and feathers of the rump cinnamon-rufous with green tips, the longer tail-coverts with the edges also rufous; middle tail-feathers with the basal half (concealed by the coverts) deep cinnamon-rufous, except along the median line, which is metallic green, like the terminal portion; three outer tail-feathers broadly tipped with white, this preceded by a broad space of purplish black, this by a smaller space of metallic green, the basal portion cinnamon-rufous, the outermost feather having a mere trace of the green, and on outer web only; fourth feather with the tip purplish black for about 0.22 of an inch, then green for about 0.20 of an inch (measured along shaft), the remaining portion cinnamon-rufous. Lores, orbital region, and ear-coverts light cinnamon; a small white spot immediately behind eye. Chin and throat white, the latero-posterior portion of the latter spotted with greenish bronze, and the lower median portion covered by an irregular patch of metallic scarlet; chest white; sides and flanks light cinnamon-rufous, fading into white on median portion of breast and belly; under tail-coverts pale cinnamon-rufous with whitish tips. Bill and feet black. Length (skin), 3.60; wing, 1.78; tail, 1.12, outer feathers 0.20 shorter; exposed culmen, 0.72.

*Young male* (No. 84129, Fort Whipple, Arizona, August 22, 1864; E. Coues): Similar to the adult female, but more golden green above, the top of the head nearly as bright as the back; middle tail-feathers chiefly rufous, but with larger dusky terminal space than in adult male; beneath as in adult female, but chin and throat conspicuously spotted, the spots small and brownish anteriorly, large and bronze-green posteriorly; center of throat showing several metallic golden red new feathers, of the adult plumage; outer primary broader.

*Young female* (No. 36912, Fort Whipple, Arizona, August 22, 1864; E. Coues): Similar to the young male, but green above much less golden, and with no rufous showing on rump, while that on upper tail-feathers is confined to the margins of the feathers; middle tail-feathers almost wholly green, only the lateral portions of the extreme base being pale brownish with a rusty tinge; outer primary broader and more curved.

Adult males vary in regard to the color of the back, which is usually (?) without a trace of metallic green, but often has more or less of this color, even the rump being sometimes mixed with green-tipped feathers. When the green is present, however, it is never continuous as in *S. alleni* nor nearly so extensive, while the peculiar form of the tail-feathers, so different from those of *S. alleni*, is just the same as in those examples which have the back and rump wholly rufous. In the color of the ruff or gorget there is very little variation, except that when the plumage becomes old the color becomes "tarnished" to a more golden or brassy hue, particularly on the tips of the feathers, this condition characterizing all of the three Mexican (winter ?) specimens in the collection, besides several of those from the United States. The color of the top of the head varies from an almost coppery bronze to a decided green hue.

Adult females vary chiefly in respect to the throat, which may be entirely without any metallic feathers, but usually has a more or less extensive irregular patch of metallic golden red; but there is also much variation in the extent and intensity of the light cinnamon-rufous of the sides and flanks.

Young males may be immediately distinguished from females by the much greater amount of rufous on the tail, the four middle feathers being chiefly of that color, though the terminal dusky spaces are much more extensive than in adult males, the white tips and subterminal black spaces of the other rectrices being essentially as in the females.

Although the mature plumage of the male usually first begins to make its appearance on the throat, there is a specimen in the National Museum collection (No. 79915, Marin County, California, April, 1880) which although having assumed entirely the adult plumage so far as other parts are concerned has only a single metallic feather on the throat.

Of all our western Humming Birds, the Rufous-backed has the widest distribution, its breeding range extending from the mountains of Arizona to latitude 61° on the coast of Alaska, and from the Pacific coast to New Mexico and Colorado. It must not be inferred from this general statement, however, that the species breeds everywhere within the wide extent of territory thus defined, for, on the contrary, certain conditions of climate and vegetation, dependent on altitude as well as latitude, are necessary for its existence. In Colorado, for example, it is said to breed only above an elevation of 6,500 feet, ranging thence up to 10,500 feet,* although in the Santa Catalina Mountains of southern Arizona, so much farther south, its breeding range is said to be between 4,000 and 6,000 feet elevation.†

In Ventura County, California, it is said to be the most abundant species of the family during summer;‡ but Mr. Belding says that in the Sierra Nevada it is a rare summer resident above 4,000 feet. It seems not to occur at all in Lower California, except possibly as a casual visitant or straggler, since Mr. Belding never met with it during his several explorations of that peninsula.

For original observations on the habits of the Rufous Humming Bird, we owe more to Mr. H. W. Henshaw than to any other writer. Mr. Henshaw found it "by far the most abundant of the family in New Mexico and Arizona, as shown in every locality visited by our party.

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* Drew, Auk., III, 1885, p. 17.

† Scott, Auk, III, 1886, p. 431.

‡ Evermann, Auk., III, 1886, p. 180.

Quite numerous at Inscription Rock, but at Apache during the month of August they were seen literally by hundreds hovering over the beds of brightly-tinted flowers, which in the mountains especially grow in the greatest profusion on the borders of the mountain-streams. This bird seems to affect no particular locality, but is about equally abundant on the high mountains, in the open tracts of pine woods, in the valleys and deep cañons, or, in fact, wherever flowers are found. The males are very pugnacious, and wage unremitting warfare on all the other species, as well as among themselves. Even as late as August it was not uncommon to see these birds still in pairs, and established in certain areas, of which they appeared to consider themselves the sole possessors, allowing no intruders. They manifested an especial animosity against the Broad-tailed Hummer, and, on the appearance of one, would instantly dart forth with shrill, angry notes, and attack and drive away the intruder, while the female, sitting on some neighboring tree, would watch the oft-repeated contest with evident interest and solicitude. At Camp Grant, during the last days of September, they were still numerous, but after leaving this point I did not again see the species."*

Mr. Henshaw found this species "quite common in summer throughout California," and breeding " apparently as common in the valleys as in the mountains." He also found it breeding near the headwaters of the Pecos River in New Mexico, and regarding their nesting there says:†

> As to their nesting, it is a curious and almost unaccountable fact that notwithstanding their great numbers we found but a single nest, and this after it was deserted. Inquiry among the settlers showed that they had never chanced upon their nests, and I judge that the greater part nest, as I found to be the case in Arizona, in the upper limbs of the pines; occasionally they nest lower. The one I found was on a dead aspen, not more than 10 feet from the ground. At the time when they are building their nests may be readily found. One has only to follow the birds straight to their nesting-sites as they bear away material in the shape of conspicuous tufts of cottony down from the willows.
>
> It seems as though *S. rufus* must breed rather less abundantly in this locality than *S. platycercus*; at all events, while the former was much less common at and for a considerable time after the date of our arrival, by August 1, when the males of *S. platycercus* had about disappeared, the males of the former species were more numerous than ever. This fact is attributed to a migration from somewhere further north, though this locality is, in truth, about the most northern limit of the species in the Rocky Mountains.
>
> A single *S. rufus* was seen September 15. It was the last bird of the season.

### ALLEN'S HUMMING BIRD. *Selasphorus alleni* HENSH.

*Selasphorus alleni* HENSH., Bull Nutt. Orn. Club, II, July, 1877, 53.

*Selasphorus rufus* (part) GOULD, Mon. Troch., pt. III, 1854, pl. 5 (green-backed specimens); vol. III, 1861, pl. 141 (do.).—ELLIOT, Class. and Synop. Troch., 1879, 110 (excl. synonymy).

Green-backed Humming Bird (COUES).

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* Rep. Orn. Spec. Wheeler's Exp., 1874, p. 131.

† The Auk, vol. III, 1886, pp. 77, 78.

Sparrow Hawks have no chance at all with them. He has often seen the little fellows in hot chase after these latter birds, and their only care seemed to be to get out of the way as soon as possible of foes so determined.

The Rufous-backed Hummer, on the contrary, frequents the thickets and is always unsuspicious and easily approached. The different localities they affect may indicate a difference in the flowers from which they obtain their food.*

The nesting habits of Allen's Humming Bird are thus interestingly described by Mr. W. Otto Emerson, of Hayward's, California:†

> I will here speak of Allen's Humming Bird (*Selasphorus alleni*), that commenced to build its nest on a running rose, under the porch roof, and within 8 feet of the floor, in front of our bedroom window, on May 27, 1885. She commenced the nest on the end of the stalk, by bringing a lot of willow cotton and webs. She would place herself on the spot chosen, then with her bill, running it here and there around the edge of the bottom, picking out a bit here and there, to place some other in its place, then working her wings in a fluttering manner to shape the nest around her body. On May 31 she laid her first egg, although the nest was not all done yet. She laid some time before 10 o'clock, as I kept watch of her, and she had been sitting all day on account of the high winds blowing the running rose stalks. By sitting close she kept the egg from rolling out. Once or twice she left the nest to get a bit of web or cotton to put around the nest. On June 1 she did not lay an egg, as the wind was blowing hard all day. So she had to keep on her nest to save her egg. The nest swung like "the cradle in the tree top" of nursery rhyme fame. The nest looked about half done, a great deal of cotton from the willows and the stamens of the Australian blue-gum tree flowers. June 3 one of the eggs got shaken out of the nest and got broken on the floor. Still she sat. On June 4 the wind was very violent and switched out the other egg. The bird would come to the nest, look in, and then dart away, hovering in the air, give two or three sharp rasping notes, and then fly off to hunt her mate to tell him of their fate. The nest still hangs there to the winter winds.

For an entertaining account of the habits of Allen's Humming Bird in captivity, the reader is referred to an article by Mrs. C. M. Crowell, in the Ornithologist and Oölogist, vol. VII, 1882, pp. 126–128.

### BROAD-TAILED HUMMING BIRD. *Selasphorus platycercus* (SWAINS.).

*Trochilus platycercus* SWAINS., Philos. Mag., I, 1827, 441.

*Selasphorus platycerus* BONAP., Rev. et Mag. Zool., 1854, 257.—GOULD, Mon. Troch. pt. III, 1852, pl. 7; vol. III, 1861, pl. 140.—COOP., Orn. Cal. I, 1870, 357.—B. B. and R., Hist. N. Am. B., II, 1874, 462, pl. 47, fig. 5.

Broad-tailed Flame-bearer (GOULD).

LeSélasphore à large queue (MULSANT and VERREAUX).

Chupamirto de pecho color de carmin (D'OCA).

RANGE.—Rocky Mountain district of United States, north to Wyoming and Utah, west to East Humboldt Mountains, Nevada (to eastern slope of Sierra Nevada?); breeding as far south as mountains of Arizona and New Mexico; in winter south over table-land of Mexico to highlands of Guatemala.

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* Bulletin of the Nuttall Ornithological Club, vol. II, 1877, pp. 55, 56.

† Ornithologist and Oölogist, vol. XI, No. 3, p. 37.

SP. CHAR.—*Adult male:* Above, metallic bronze-green; tail, except middle feathers, purplish black; the fourth (sometimes third also) edged with rufous—rarely some of the tail-feathers with small whitish terminal spots; gorget, metallic wine-purple or solferino; length (before skinning) about 4.00–4.70; wing, 1.85–2.05; tail, 1.35–1.60; exposed culmen, 0.60–0.70. *Adult female* similar above to the male, but three or four outer tail-feathers extensively rufous at base, the three outer ones with broad white tips; chin and throat white, more or less streaked or dotted with brownish; sides and flanks pale rufous or cinnamon-buff; length, about 3.60–4.70; wing, 2.00–2.10; tail, 1.35–1.50; exposed culmen 0.70–0.72.

*Adult male* (No. 10847, Ft. Bridger, Wyoming, May 30, 1858; C. Drexler): Above, metallic bronze-green, including whole top of head and middle pair of tail-feathers; remiges dull brownish slate or dusky, very faintly glossed with purplish; tail-feather next to middle pair dark metallic green on inner web, the outer web purplish black, glossed with green toward end, and broadly edged with rufous; next wholly purplish black, except a very narrow rufous edging to both webs; next similar, but with rufous edging to outer web confined to basal portion; outer feather with no rufous edging to either web; a minute white spot immediately behind eye; gorget, metallic rose-purple; chest, median line of breast and belly, anal region and under tail-coverts white, the the longer feathers of the latter with a central mark of dusky; sides and flanks metallic bronze-green, the latter tinged with rusty. Bill and feet black. Length (skin), 3.60; wing, 2.00; tail, 1.35; exposed culmen, 0.68.

*Adult female* (No. 94680, Santa Fé, Mountains, New Mexico, August 1; H. W. Henshaw): Above, bronze-green, becoming dull, dusky, grayish brown on forehead and crown; remiges dull brownish slate, very faintly glossed with purplish; tail-feathers next to middle pair with about the basal half rufous, then a triangular patch of metallic green, this succeeded by a patch of purplish black (its transverse anterior outline .35 from the tip), the apex of the feather formed by a small roundish spot of dull buff; next feather tipped with a large oval spot of white, and the green between the subterminal black and basal rufous much reduced (only about 0.10 of an inch wide); next similar, but with the green still more reduced and the white terminal spot correspondingly larger; outer feather with the white tip 0.35 long, and a mere trace of green between the black and the rufous. Chin and throat white, each feather with a small central spot of dull bronze; chest, white; median line of breast and belly and under tail-coverts white, tinged with pale rufous or ochraceous-buff; sides and flanks deep ochraceous-buff or cinnamon-buff; bill and feet black. Length (skin), 3.60; wing, 2.10; tail, 1.35 (outer feathers, 0.15 shorter); exposed culmen, 0.72.

The principal variation in adult males consists in the coloration of the exterior tail-feathers, one or more of which frequently show more or less distinct whitish spots at the tips. In fact, of the ten specimens at this moment under examination, as many as six possess this character, more or less pronounced, thus showing that it is by no means exceptional. In three of these it is confined to an indistinct edging to the terminal portion of the inner web of the lateral feather, the second having merely a trace of this whitish edging. In the others, however, the white amounts to a considerable spot at the tip of both webs, and is present on the third as well as the first and second, though much reduced in extent. The color of the gorget varies but little, except in a specimen from Mexico (No. 60073, A. Boucard), in which it is more of a geranium red, caused by the tips of the feathers being "tarnished" to a more golden hue.

An adult male from Guatemala (No. 33647, O. Salvin) differs from more northern specimens only in smaller size, its measurement being as follows: Length (skin), 3.45; wing, 1.85; tail, 1.40; exposed culmen, 0.60.

Adult females, as in *Trochilus alexandri* and other species, vary chiefly in the markings of the chin and throat, some having the central guttate spots to the feathers pale grayish brown or olive and very small, while others have these markings much darker in color as well as larger. In none of the specimens examined, however, are there any metallic feathers on the throat, such as are frequently seen in females of *S. rufus* and *S. alleni*. An example from Mexico (No. 13636, J. Gould) differs from United States examples in having the basal portion of the rectrices much duller rufous, this color also much more restricted. The specimen may, however, possibly be a young male.

The Broad-tailed Humming Bird is the most common, or at least most conspicuous, species of the family in the Rocky Mountain district, although it seems to be more particularly characteristic of the eastern portions, gradually diminishing in numbers, or at least in the continuity of the areas which it inhabits, to the westward. I am unable to find any authentic record of its occurrence west of the one hundred and sixty-first meridian, where in the East Humboldt Mountains, Nevada, I found it fairly common in August, 1868.

In the Rocky Mountain district proper, as in Colorado, for example, it breeds at an elevation of from 4,000 to 11,000 feet,* and I found it having about the same vertical range in the East Humboldt Mountains. In the San Francisco Mountains, Arizona, according to Dr. Mearns,† it is an abundant summer resident of the spruce belt. At Fort Garland, Colorado, Mr. Henshaw found it most numerous along the mountain streams, at an altitude of about 7,000 feet. It breeds abundantly in the mountains of northern New Mexico, but in those of southern Arizona it is said to be comparatively rare during the breeding season. On the Upper Pecos River, New Mexico, Mr. Henshaw found the Broad-tailed Humming Birds "extremely numerous; young birds were noticed August 1, and by the 10th they became common. By August 1, the males of this species began to get less numerous, and by the 10th there were none; in fact, I saw very few after that date. This is an extremely interesting fact. Wherever I have been in the West, and for that matter in the East also, I have always been led to wonder at the apparent absence of males early in fall in localities where the females and young were very numerous. The observations I was able to make here solved the problem to my satisfaction. The truth appears to be that *immediately* upon the young leaving the nest the males abandon their summer limits and at once set out for their winter quarters, leaving the females and young to follow at their convenience.

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* Drew, The Auk, vol. III, p. 17.

† The Auk, vol. VII, p. 255.

In this locality at least there is an evident reason for this. Just about this date the *Scrophularia*, which is the favorite food plant of the Hummers, begins to lose its blossoms, and in a comparatively short time the flowers give place to the seed pods. Though there are other flowers which are resorted to by the Hummers, particularly several species of *Pentstemon*, they by no means afford the luxurious living the former plant does. It seems evident, therefore, that the moment its progeny is on the wing, and its home ties severed, warned of the approach of fall alike by the frosty nights and the decreasing supply of food, off go the males to their inviting winter haunts, to be followed not long after by the females and young. The latter—probably because they have less strength—linger last, and may be seen even after every adult bird has departed."*

In the San Francisco Mountains, Arizona, Dr. Merriam found them "very abundant in the balsam belt and the upper part of the pine belt. A nest containing two nearly fledged young was found on the limb of a Douglas fir, about 4 feet from the ground, July 31. The principal food plant of this Humming Bird is the beautiful scarlet trumpet flower of *Pentstemon barbatus torreyi*. During the latter part of August and early September, after it had ceased flowering, these birds were most often seen in the beds of the large blue larkspur (*Delphinium scopulorum*); They wake up very early in the morning and go to water at daylight no matter how cold the weather is. During the month of August, and particularly the first half of the month, when the mornings were often frosty, hundreds of them came to the spring to drink and bathe at break of day. They were like a swarm of bees, buzzing about one's head and darting to and fro in every direction. The air was full of them. They would drop down to the water, dip their feet and bellies, and rise and shoot away as if propelled by an unseen power. They would often dart at the face of an intruder as if bent on piercing the eye with their needle-like bill, and then poise for a moment almost within reach before turning, when they were again lost in the busy throng. Whether this act was prompted by curiosity or resentment I was not able to ascertain. Several were seen at the summit of the mountain during the latter part of August. They were found also at the Grand Cañon of the Colorado, September 12 to 15. They began to leave the mountain during the first week in September, and none were seen after the middle of the month.*

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* The Auk, vol. III, 1886, p. 75.

Mr Henshaw mentions the marked hostility existing between this Humming Bird and the Rufous-backed species, but adds that, "in the fall, when migrating, they are brought by the similarity of tastes and habits into the same localities, and their combined numbers are in some favored spots in Arizona simply surprising. The beds of bright flowers about Willow Spring, in the White Mountains, Arizona, were alive with them in August, and as they moved swiftly to and fro, now surfeiting themselves on the sweets they here found so abundant, now fighting with each other for possession of some such tempting prize as a cluster of flowers, their rapid motions, and the beauty of their colors, intensified by the bright sunlight—the gorgets of gold and purple contrasting against their emerald and bright-red bodies—conspired to an effect not soon to be forgotten."†

### Genus **STELLULA** GOULD.

*Stellula* GOULD, Introd. Troch. 1861, 90. Type, *Trochilus calliope* GOULD.
*Stellura* MULS. and VERR., Class. Troch. 1865, 88. Same type.

GENERIC CHARACTERS.—Six middle tail-feathers contracted in the middle and widened for the terminal portion, being thus of somewhat spatulate or pandurate form; *adult male* with feathers of chin and throat narrow, those of the latero-posterior portion of the latter elongated so as to form a conspicuous ruff, only their terminal half metallic, the basal portion being pure white; middle tail feathers without any green.

This genus appears to be most nearly related to *Atthis*, but is quite distinct in the peculiar form and coloration of the feathers of the gorget, as well as of the rectrices. But one species is known, this being easily distinguished, in all stages of either sex, by the peculiar form of the tail feathers, as noted above.

### CALLIOPE HUMMING BIRD. *Stellula calliope* GOULD.

(PLATE XLI.)

*Trochilus* (*Calothorax*) *calliope* GOULD, P. Z. S. 1847, 11.
*Stellula calliope* GOULD, Introd. Troch. Oct. ed. 1861, 90.—COOP., Orn. Cal. I, 1870, 363.—B. B. and R., Hist., N. Am. B. II, 1874, 445, pl. 47, fig. 9.
*Calothorax calliope* GOULD, Mon. Troch. pt. XV, 1857, pl. 2; vol. III, 1861, pl. 142.
Mexican Satellite (GOULD).
Star-throated Humming Bird.
Satellite Humming Bird.
La Stellure calliope (MULSANT and VERREAUX).
Chupamirto de rafaguita (D'OCA).

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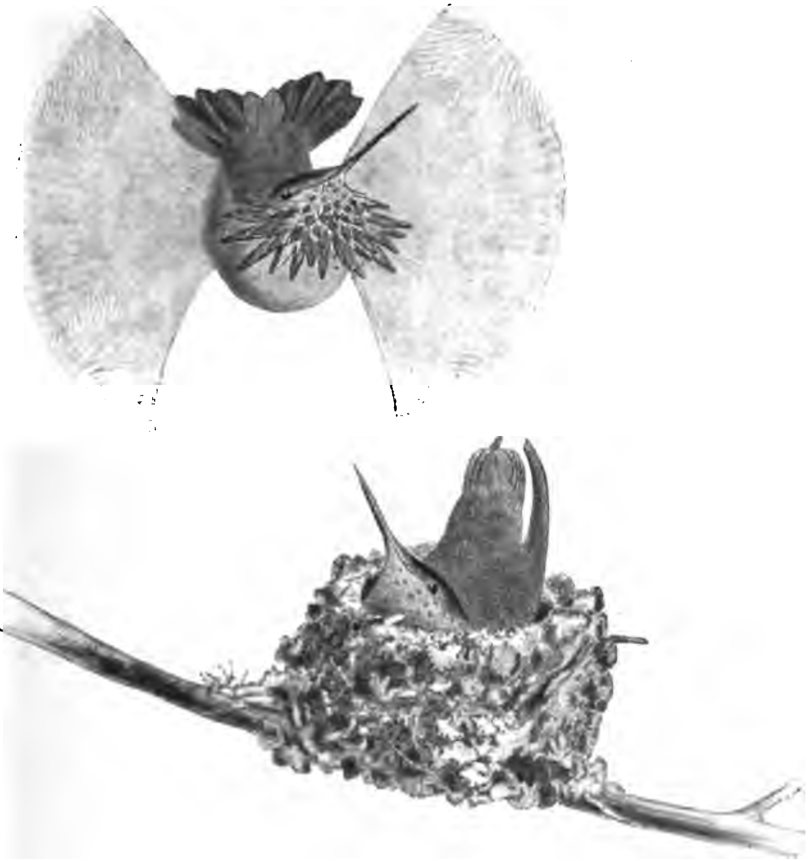
* North American Fauna, No. 3, p. 93.

† Zoölogy of Wheeler's Expedition, p. 378.



CALLIOPE HUMMING BIRD (*Stellula calliope*).
Male. (Cat. No. 67201, U. S. N. M. El Moro, New Mexico. Collected by H. W. Henshaw.)
Female. (Cat. No. 77447, U. S. N. M. Honey Lake, California. Collected by H. W. Henshaw.)
Nest. (Cat. No. 18914, U. S. N. M. Baird, California. Collected by Charles H. Townsend.)

RANGE.—Mountain districts of western United States, north to British Columbia, east to Montana, Utah, New Mexico, etc., and south over table-lands of Mexico; breeding south as far as San Bernardino Mountains, in California, and mountains of northern New Mexico.

SP. CHAR.—*Adult male* with the narrow and very distinctly outlined feathers of the gorget pure white basally, metallic reddish purple terminally; middle tail feathers somewhat spatulate, purplish black, edged with rufous toward base and broadly tipped with dull brownish gray; remaining rectrices similar but without distinct grayish tips and rufous basal edgings less distinct or even obsolete; under parts white, the sides and flanks metallic green mixed or washed with pale rusty; length (before skinning) about 3.10–3.30, wing 1.50–1.60, tail 0.80–1.10, exposed culmen 0.55–0.58. *Adult female* metallic bronze-green above, including the slightly spatulate middle tail-feathers; three outer tail-feathers broadly tipped with white, extensively black subterminally, the basal portion dull greenish, becoming buffy or pale rusty at extreme base; under parts white, the sides, flanks and under tail-coverts pale rusty or cinnamon-buff, the throat more or less spotted with brownish; length about 3.35–3.50, wing 1.75–1.80, tail 0.85–1.15, exposed culmen 0.58–0.60.

*Adult male* (No. 67201, El Moro, New Mexico, July 29, 1873; H. W. Henshaw): Above metallic bronze-green, becoming duller on forehead; remiges dull brownish slate, very faintly glossed with purplish; middle pair of tail-feathers dull black, broadly edged with rusty basally, and broadly tipped with dusky brownish gray (as if faded); rest of rectrices similar but fading gradually at tips into dusky brownish gray, and rusty basal edgings less distinct—quite obsolete on outer feather. Gorget with the feathers pure white for basal half or more, the terminal portion metallic solferino-purple; chest, sides of neck, and under tail-coverts pure white; median line of breast and belly dull white; sides and flanks bronze-green. Bill and feet brownish black.* Length (skin), 2.75†; wing, 1.50; tail, 0.80; exposed culmen, 0.58.

*Adult female* (No. 91748, Baird, California, May 29, 1883; Chas. H. Townsend): Above, metallic bronze-green, including middle pair of tail-feathers, which are entirely without rufous, even at extreme base; tail-feather next to middle pair dark metallic green, both webs edged with rusty toward base, the terminal portion of outer web black (for about 0.25 of an inch), the corresponding portion of inner web inclining to the same; next feather with a considerable terminal spot of white, this preceded by a black band more than 0.25 of an inch wide, the remaining portion metallic green, broadly edged toward base with rusty; next feather similar, but white spot larger and rusty edgings less distinct; outer feather with the white about equal to the black in extent, the basal portion dull brownish gray, faintly tinged with green next to the black, the shaft being very pale brown or buffy. Chin and throat white, faintly flecked with brown, with larger and much more distinct spots of bronzy green on the latero-posterior portion; rest of under parts pale cinnamon-buff, the belly nearly white. Bill and feet blackish. Length (skin), 3.10;[*] wing, 1.68; tail, 0.85, the lateral feathers about 0.10 shorter; exposed culmen, 0.60.

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*According to Dr. J. C. Merrill (The Auk, July, 1888, p. 257), the fresh colors are as follows: "Upper mandible dead black, the lower light flesh color darkening towards the tip, which was black; the feet dark flesh-color, the irides brown."

†Specimens in the flesh, according to Dr. Merrill, measure in length from 3.10 to 3.30; a young male shot by me measured $2\frac{14}{16}$ in length.

*Young male* (No. 69135, Mt. Graham, Arizona, September 20, 1874; H. W. Henshaw): Not essentially different from some adult females. Middle of throat showing several metallic reddish purple (new) feathers.

Adult males vary slightly in the color of the metallic portion of the throat-feathers, which in some are a little less reddish purple than in the example described. Some specimens show a decided pale cinnamon or cinnamon-buff wash on sides and flanks, others having scarcely a trace of it. There is the usual range of variation in the color of the upper parts, which may be nearly pure green or with a decided bronzy hue, the latter, however, exceptional in the considerable series examined.

Adult females vary chiefly in the distinctness of the small dusky markings on the throat, which are sometimes quite obsolete except laterally and posteriorly, and the middle pair of tail-feathers sometimes show a slight rusty edging near the base and a black terminal space.

This is the smallest of our North American Humming Birds, but, notwithstanding its diminutive size, has a very extensive distribution, ranging farther north than any other of the western species except *Selasphorus rufus*, and extending from the Pacific Coast nearly, if not quite, to the main chain of the Rocky Mountains. Like the Rufous Humming Bird, however, it does not inhabit every portion of the extensive region indicated, but only such parts as are suited to it by topographical or climatic conditions. In California, according to Mr. Stephens,[†] it breeds as far south as the San Bernardino Mountains, where it inhabits the pine region, but in most parts of that State it is, according to Mr. Belding, rare and chiefly a migrant, though breeding in the Sierra Nevada above 4,000 feet. Mr. Townsend[‡] found it breeding abundantly on the McCloud River, in the northern part of the State, as did Dr. Merrill[§] at Fort Klamath, Oregon. Dr. Merriam[||] obtained a female on the 3d of July at Fort Ellis, Montana, where the species was doubtless breeding, and Mr. John Fannin records it as a common summer resident at Buzzard Inlet, British Columbia. It has not yet been taken in Colorado; but it may be expected to occur in the western portion of that State, since the present writer found it to be not uncommon in the Wasatch Mountains of Utah, where in fact it was almost as numerous as was *Selasphorus platycercus.* Mr. Henshaw found it rather numerous in summer along the Upper Pecos River, in New Mexico. In the Santa Catalina Mountains of southern Arizona it appears to be merely a transient, Mr. Scott* having met with it only during April and August, only a single example having been seen by him on each occasion, and he observes that Mr. Herbert Brown has not found it about Tucson, nor indeed at other points in Arizona visited by him. Hence we may infer that it is, like the Rufous Humming Bird, essentially a northern or alpine species, so far as its breeding range is concerned.

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[*] Before skinning, this specimen measured $3\frac{1}{3}$ or about 3.33 inches in length; a female measured by Dr. Merrill was 3.35 long, while two measured in the flesh by myself were respectively $3\frac{9}{16}$ and 3.50 long.

[†] Land Birds of the Pacific District, by Lyman Belding, 1890, p. 89.

[‡] Pr. U. S. Nat. Mus., vol. x, p. 209.

[§] The Auk, vol. v, 257.

[||] Sixth An. Rep. Geol. Surv. Terr., 1873, p. 693.

Regarding its probable breeding in northern New Mexico, Mr. Henshaw writes as follows:†

> This, the most diminutive of our Hummers, is rather numerous in summer in the locality in question, much further north than which it does not go.‡ The species has not yet been detected in Colorado, though I doubt not but that the higher mountains of the southern portion of that State afford a summer home for some of them. It is a curious fact in connection with the history of this species, as well as that of the *S. rufus*, that while both of them range far to the northward in the Sierra Nevada, reaching Washington Territory, and even going beyond into Alaska, they yet decline to visit even the middle portion of the Rocky Mountains, but confine their range to their southern parts. The Calliope Hummer is, as compared with the other species mentioned, a rare bird. It is also much less obtrusive, and in the contests of its larger neighbors it takes no part. When assailed, as it promptly is by the other kinds, it at once darts away to another spot where it can feed without molestation. It appears to be timid in every way, so much so that it is not an easy bird to collect. An utterly unaccountable fact noticed in connection with this species was the apparent rarity of females. Up to August 10 I had seen perhaps half a dozen, though constantly on the watch for them, while I had certainly seen not less than ten times that number of males. Subsequent to that date I saw a few more, but nothing like the number of males.
>
> By September the young were numerous in certain localities, notably in a large sunflower patch.

Some points in the breeding habits of the Calliope Humming Bird are thus described by Dr. Merrill, in the Auk for July, 1888, p. 257, the locality being Fort Klamath, Oregon:

> First taken May 17. A few Hummers, apparently of this species, had been seen for 10 days before this date, but they were not abundant until the 16th, after which the males were common about the blossoms of wild currant and gooseberry bushes. During the breeding season they are generally distributed, and are to be found in deep pine woods as well as in more open places, the constant sharp, shrill notes of the males indicating their presence and abundance. When pairing soon after their arrival, and with less frequency during the period of incubation, the males have a habit ef poising themselves for some seconds at a height of 30 or 40 feet above the ground, and then dashing down nearly to the earth, rising as quickly to poise again, and repeating

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* See The Auk, vol. III, 1886, pp. 431, 432.

† The Auk, vol. III, p. 78.

‡ It has, however, subsequently been recorded from localities very much farther north.—R. R.

the maneuver often; at such times their notes are particularly loud and attract attention from a considerable distance.

A nest brought to me about the middle of July, and which the young had just left, was placed upon a dead flattened cone of *Pinus contorta*. It was composed of thin strips of a gray bark, with a few spiders' webs on the outside; the lining was similar, but with a few small tufts of a cottony blossom from some tree; the nest was just the color of the cone and was admirably adapted to escape notice. Another nest containing two nearly fledged young was found at about the same time, but was quite unlike the one just described in construction and situation, being of the common Humming Bird type and saddled upon a dead willow twig. One of the young birds lived for about a week, becoming very tame and feeding greedily upon sirup.

### Genus **CALOTHORAX** GRAY.

*Calothorax* GRAY, Gen. B., 1840, 13. Type, *Cynanthus lucifer* SWAINS.

*Lucifer* REICH., Synop. Av. Nat., 1849, pl. 39; Aufz. Colib., 1854, 13; Troch. Enum. 1855, 10. Same type.

*Cyanopogon* "REICH." BONAP., Ann. Soc. Nat., 1854, 138. Same type.

*Manilia* MULS. and VERR., Classif. Troch., 1865, 86. Type, *Calothorax pulchra* GOULD.

GENERIC CHARACTERS.—Bill much longer than the head, distinctly curved (except in *C. pulchra*); tail forked, the three outer feathers narrow, and plain purplish black, in adult males; gorget of adult males rich metallic amethyst, or magenta, purple with violet and blue reflections; females with tail double-rounded and deeply emarginate, the three outer feathers rufous at base, then black, tipped with white; under parts light ochraceous.

This genus is most nearly related to both *Doricha*, REICH.,* and *Acestrura*, GOULD,† between which it is nearly intermediate. In fact the three should probably be merged into one genus, *Calothorax*, with *Doricha* and *Acestrura* (including perhaps one or more subdivisions of the former) as subgenera.

The two known species of *Calothorax* are very much alike in coloration, but differ so decidedly in structural characters that little difficulty need be experienced in identifying them. Their differential characters are as follows:

$a^1$. Bill with exposed culmen about one and a half times as long as the head, distinctly curved; *adult male* with outer primary broader, and outer pair of tail-feathers very narrow, as well as pointed; *adult female* with belly white, and lateral pair of tail-feathers shorter than middle pair. HAB.: Table-lands of Mexico, north to southern Arizona.

*C. lucifer* (SWAINS.). *Lucifer Humming Bird.* (Page 359.)

$a^2$. Bill with exposed culmen only a little longer than the head, much more slender, and not decidedly curved; *adult male* with outer primary narrower, and outer pair of tail feathers much broader, and not pointed at ends; *adult female* with belly buffy, only a little paler than breast, &c., and outer pair of tail-feathers longer than middle pair. HAB.: Southwestern Mexico (Oaxaca, &c.).

*C. pulchra* GOULD. *Beautiful Humming Bird.*‡

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* *Doricha* REICH., Aufz. der Colib. 1853, 12. Type, *Trochilus enicurus* VIEILL.

† *Acestrura* GOULD, Introd. Troch., Oct. ed. 1861, 91. Type, *Ornismya mulsanti* BOURC.

‡ *Calothorax pulchra* GOULD, Ann. Mag. N. H., 3d ser., IV, 1859, 97; Mon. Troch., III, pl. 144.—*Manilia pulchra* MULSANT and VERREAUX, Hist. Nat. Ois.-Mouch., IV, 1877, 30, pl. 36.

### LUCIFER HUMMING BIRD. *Calothorax lucifer* (SWAINS.).

(Plate XLII.)

*Cynanthus lucifer* SWAINS., Philos. Mag., I, 1827, 442.
*Calothorax lucifer* GRAY, Gen. B., I, 1848, 110.—LAWR., Bull. Nutt. Orn. Club, II, 1877, 108 (Camp Bowie, Ariz.).
*Ornismya cyanopogon* LESS., Ois.-Mouch., 1829, 50, pl. 5.
*Calothorax cyanopogon* GRAY, Gen. B., I, 13.—GOULD, Mon. Troch., pt. XIV, 1857, pl. 1; vol. III, 1861, pl. 143.
*Doricha enicura* (error) HENSH., Am. Sportsm., V, Feb. 20, 1875, 328 (Camp Bowie, Ariz.); Zoöl. Wheeler's Exp. 1875, 381.
Mexican Star (GOULD).
Le Calothorax Barbe-Bleue (MULSANT and VERREAUX).
Chupamirto morado grande (D'OCA).
Oiseau-Mouche Barbe-Bleue (PRÉVOST).

RANGE.—Table-lands of Mexico, north to southern Arizona.

SP. CHAR.—*Adult male* with the gorget rich metallic violet, varying to purplish blue; upper parts metallic bronze-green, the three outer tail-feathers purplish black, the outermost one excessively narrow; chest buffy white, belly and under tail-coverts purer white; sides and flanks dull greenish bronze, tinged with rusty; length, about 3.40-3.80; wing, 1.40–1.60; tail, 1.20–1.35 (forked for nearly half its length); exposed culmen, 0.75–0.90; the bill strongly curved. *Adult female* bronze-green above, including middle pair of tail-feathers; three outer tail-feathers light cinnamon-rufous for about the basal half, then black, the tips broadly white; post-ocular stripe, sides of neck, chin, throat, malar region, sides, and flanks pale cinnamon-buff; belly white; length (skin), about 3.30; wing, 1.65–1.80; tail, 1.20–1.25; exposed culmen, 0.75–0.90.

*Adult male* (No. 97727, Tupátaro, Mexico; Prof. A. Dugès): Above, metallic bronze-green, duller on top of head, more decidedly bronzy on rump and upper tail-coverts; remiges dull dusky slate, faintly glossed with purplish; four middle tail-feathers metallic green (scarcely bronzy), the other tail-feathers purplish dusky, some of them tinged at tips with metallic green, others minutely tipped with white. Gorget rich metallic magenta-purple, changing to violet in certain lights; chest dull white, tinged laterally and posteriorly with pale rusty; middle line of belly whitish, sides and flanks metallic bronze-green, tinged with rusty; under tail-coverts white, some of the feathers faintly bronzy-grayish at base; bill and feet black. Length (skin), 3.80; wing, 1.50; tail, 1.20, the middle feathers 0.50 shorter; exposed culmen, 0.85.

*Adult female* (No. 35170, Mirador, Mexico; Dr. C. Sartorius): Above, metallic golden green, much duller on top of head, the middle tail-feathers nearly pure green; remiges dull brownish slate or dusky, very faintly glossed with purplish; tail-feathers next to middle pair chiefly metallic green, the terminal portion black, shaft of the green portion pale rufous, and outer web broadly edged toward base with cinnamon-rufous; next feather with more than the basal half of both webs, including shaft, cinnamon-rufous, the subterminal portion (for about 0.30 of an inch) black,* the tip (for about 0.15 of an inch) white; next feather similar, but with white tip more extensive; outer feather similar, but white tip still more extensive (about 0.22 long), the black correspondingly reduced, and no green between the black and the rufous. Broad post-ocular stripe (commencing above the eye), sides of neck, chin, throat, malar region, sides, and flanks uniform light cinnamon-buff, deepest on flanks; chest mixed white and cinnamon-buff; belly white; under tail-coverts pale creamy buff; bill and feet black. Length (skin), 3.30; wing, 1.65; tail, 1.10 (middle feathers 0.10 shorter and outer pair 0.20 shorter); exposed culmen, 0.80.

A female (perhaps not adult) from Arizona (No. 72535, near Camp Bowie, August 7, 1874, H. W. Henshaw) is quite similar in coloration to that described above, except that the entire chin and sides of the throat are dull grayish white, only the median portion of the throat (to within about 0.30 of an inch of the chin angle) being cinnamon-buff. Measurements are as follows: Length (skin), 3.35; wing, 1.70; tail, 1.00; exposed culmen, 0.85.

> The claim of this beautiful species [says Mr. Henshaw†] to a place in our fauna rests upon the capture of a single female near Camp Bowie, Arizona. * * * I regret that I am unable to give any information respecting either its habits or its relative abundance in Arizona. Probably it is rare, for here, as in certain other points in southern Arizona, the attention of the party was especially directed to the humming birds, the occurrence of novelties being rendered more probable by the abundance of certain other species, and at Camp Bowie notably by the great number of *Trochilus alexandri*. The well-known agave plants of this region were here very abundant, and their tall upright stems, surmounted by the short lateral stems, with their spreading bunches of blossoms, dotted the rocky hillsides in every direction and gave a strange, weird aspect to the landscape. Around these humming birds congregated, showing an especial liking for the nectar of the flowers, or possibly finding in them rich storehouses of the minute forms of insect life, which is the chief part of their diet. By taking a station near one of these, one could easily watch the motions of these little feathered gems as they darted to and fro, and, had any other species been even tolerably numerous, it could scarcely have eluded our attention.

Fortunately Mr. Gould has been able to give us, in his beautiful Monograph of the Trochilidæ (vol. III, p. 143), a rather full life-history of the Lucifer Humming Bird, which is herewith transcribed:

> This beautiful species, so well known by its trivial name of "Mexican Star," is a denizen of the table-lands of that rich country, Xalapa, the land of perpetual spring and of unsurpassed climate. It was in this fine region that the bird came under the observation of the late Mr. Bullock, to whom we are indebted for all that is known respecting it, and which is comprised in the following extracts from his Six Months in Mexico:
>
> "The house I resided in at Xalapa for several weeks was only one story high, inclosing, like most of the Spanish houses, a small garden in the center, the roof projecting 6 or 7 feet from the walls, covering a walk all around and leaving a small space only between the tiles and the trees which grew in the center. From the

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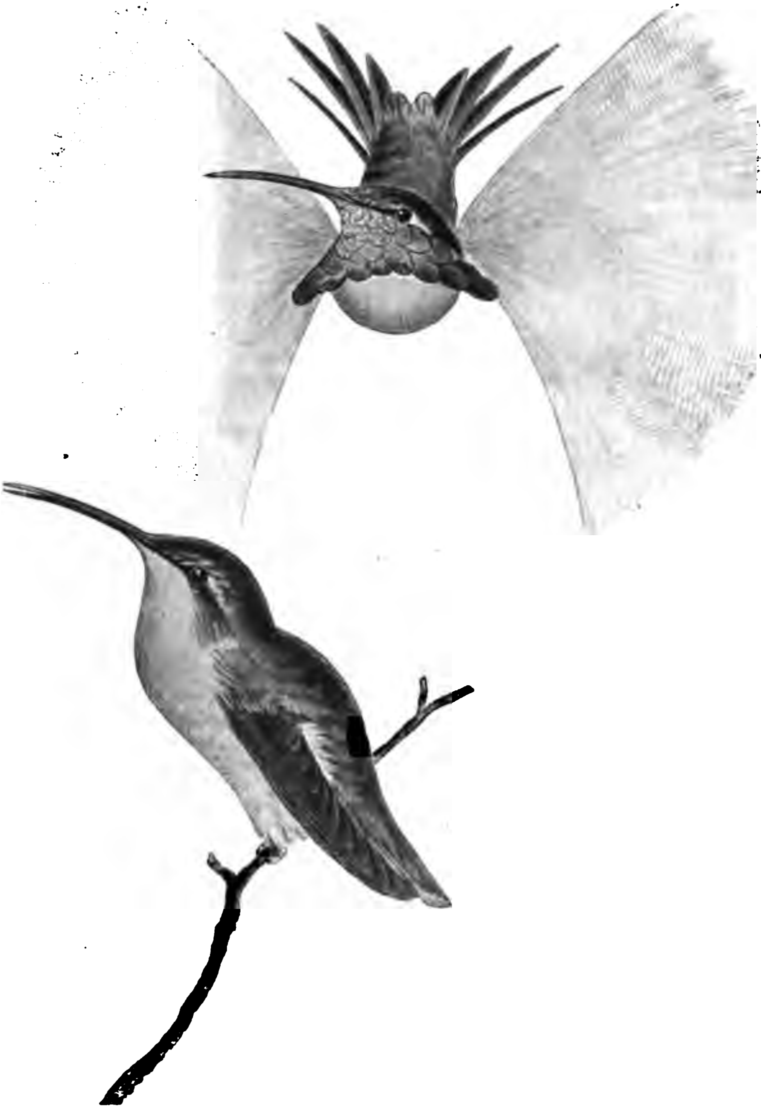
* There is a small space of metallic green separating the rufous from the black.

† Zoölogy of Wheeler's Survey, 1875, p. 382.



LUCIFER HUMMING BIRD (*Calothorax lucifer*).
**Male.** (Cat. No. 85862, U. S. N. M. Valley of Mexico. Collected by A. W. Butler.)
**Female.** (Cat. No. 115294, U. S. N. M. Arizona. Collected by O. T. Baron.)

edges of these tiles to the branches of the trees in the garden the spiders had spread their innumerable webs so closely and compactly that they resembled a net. I have frequently watched, with much amusement, the cautious peregrination of the Humming Bird, who, advancing beneath the web, entered the various labyrinths and cells in search of entangled flies, but, as the larger spiders did not tamely surrender their booty, the invader was often compelled to retreat; being within a few feet, I could observe all their evolutions with great precision. The active little bird generally passed once or twice around the court, as if to reconnoiter his ground, and commenced his attack by going carefully under the nets of the wily insect and seizing by surprise the smallest entangled flies, or those that were most feeble. In ascending the angular traps of the spider, great care and skill were required; sometimes he had scarcely room for his little wings to perform their office, and the least deviation would have entangled him in the complex machinery of the web and involved him in ruin. It was only the works of the smaller spider that he durst attack, as the larger sort rose to the defense of their citadels, when the besieger would shoot off like a sunbeam and could only be traced by the luminous glow of his refulgent colors. The bird generally spent about 10 minutes in this predatory excursion and then alighted on a branch of the Avocata to rest and refresh himself, placing his crimson star-like breast to the sun, which then presented all the glowing fire of the ruby and surpassed in luster the diadem of monarchs. Europeans who have seen only the stuffed remains of these little feathered gems in museums have been charmed with their beautiful appearance, but those who have examined them whilst living, displaying their moving crests, throats, and tails, like the Peacock, in the sun, can never look with pleasure on their mutilated forms. I have carefully preserved about two hundred specimens in the best possible manner, yet they are still but the shadow of what they were in real life. The reason is obvious, for the sides of the laminæ or fibers of each feather, being of a different color from the surface, will change when seen in a front or oblique direction, and, as each lamina or fiber turns upon the axis of the quill, the least motion, when living, causes the feathers to change suddenly to the most opposite hues. Thus the one from Nootka Sound changes its expanded throat from the most vivid fire color to light green; the Topaz-throated does the same, and the Mexican Star changes from bright crimson to blue.

"The sexes vary greatly in their plumage, so much so that the male and female could not have been known had they not been seen constantly together and proved to be so by dissection. They breed in Mexico in June and July; and the nest is a beautiful specimen of the architectural talent of these birds; it is neatly constructed with cotton or the down of the thistle, to which is fastened on the outside, by some glutinous substance, a white, flat lichen resembling ours.

"The female lays two eggs, perfectly white and large for the size of the bird; and the Indians informed me they were hatched in 3 weeks by the male and female sitting alternately. When attending their young they attack any bird indiscriminately that approaches the nest. Their motions when under the influence of anger or fear are very violent, and their flight rapid as an arrow; the eye can not follow them; but the shrill, piercing shriek which they utter on the wing may be heard when the bird is invisible. They attack the eyes of the larger birds, and their sharp, needlelike bill is a truly formidable weapon in this kind of warfare. Nothing can exceed their fierceness when one of their own species invades their territory during the breeding season. Under the influence of jealousy they become perfect furies; their throats swell, their crests, tails, and wings expand; they fight in the air (uttering a shrill noise) till one falls exhausted to the ground. I witnessed a combat of this kind near Otumba during a heavy fall of rain, every separate drop of which I supposed sufficient to have beaten the puny warriors to the earth.

"In sleeping they frequently suspend themselves by the feet, with their heads downwards, in the manner of some parrots.

"These birds were great favorites of the ancient Mexicans. They used the feathers as ornaments for their superb mantles in the time of Montezuma, and in embroidering the pictures so much extolled by Cortez. Their name signifies in the Indian language 'beams or locks of the sun,' and their feathers are still worn by the Indian ladies as ornaments for the ears."

I have numerous specimens of this bird in my collection, and observe that those procured in one locality differ somewhat from those obtained in another; for instance, the examples collected by my friend Floresi in the neighborhood of the Real del Monte mines are larger and altogether more powerful birds than those brought to this country by M. Sallé and other collectors from Cordova. Bullock speaks with great truth when he states that the sexes differ considerably, for it is only those persons who are conversant with this extensive group as a whole who can, with any degree of certainty, pair many of the species.

### Genus **AMAZILIA** REICHENBACH.

*Amazilia* REICH., Syst. Av., 1849, pl. 39. Type, *Orthorhynchus amazili* LESS.

*Amazilis* GRAY, Gen. B., I, 1840.—*Amazilius* BONAP., 1849.—*Amazillia*, SCL. and SALV., 1859.

*Pyrrhophæna* CAB. and HEINE, Mus. Hein., III, 1860, 35. Same type.

*Hemithylaca* CAB. and HEINE, Mus. Hein., III, 1860, 37. Type, *Trochilus niveoventris* GOULD.

*Hemistilbon* GOULD, Introd. Troch., oct. ed., 1861, 149. Type, *Amazilia ocai* GOULD.

*Eranna* HEINE, J. f. O. 1863, 187. Type, *Ornismya cinnamomea* LESS.

*Eratina* HEINE, J. f. O., 1863, 190, 191. Type *Trochilus iodurus* SAUCEROTT.

*Ariana* MULS. and VERR., Class. Troch., 1866, 36. Type, *Trochilus niveoventer* GOULD.

*Leucodora* MULS. and VERR., Hist. Nat. Ois.-Mouch., I, 1877, 309. Type, *Trochilus edwardi*, BOURC. and DELATTR.

*Myletes* (subgenus) MULS. and VERR., Hist. Nat. Ois.-Mouch., I, 1877, 284. Type, *Trochilus yucatanensis* CABOT.

*Saucerottia* BONAP., Compt.-Rend., 1850, 381. Type, *Trochilus saucerottii* BOURC. and DELATTR.

*Erythronota* GOULD, Intr. Troch., oct. ed., 1861, 16. *Ornismya erythronota* LESS.

*Eratopis* HEINE, J. f. O., 1863, 191. Type, *Trochilus cyanifrons* BOURC.

*Erasuria* HEINE, J. f. O., 1863, 191. Type, *Erythronota elegans* GOULD.

*Lisaria* MULS., Cat. Ois.-Mouch., 1875, 11. Type, *Hemithylaca warszewiczi* CAB. and HEINE.

GENERIC CHARACTERS.—Bill longer than head, straight; nostrils uncovered; wing normal; tail more than half as long as wing, emarginate, the feathers broad and rather stiff; tarsi densely feathered; under parts plain metallic green, plain cinnamon-rufous, or green anteriorly, and white, buff, or cinnamon-rufous posteriorly, the chest sometimes white; tail chestnut, purplish black, or blue-black; sexes alike.

Although the two dozen or more species which Mr. D. G. Elliot[*] has included in this genus have usually been distributed through a greater or less number of so-called genera, I am forced by a careful examination and comparison of the types of the several generic names given in the above synonymy to agree with the gentleman just mentioned in his reduction of these names to the rank of synonyms. *Amazilia ocai* Gould and *Erythronota elegans* Gould, I have not seen, but have little doubt that the names *Hemistilbon* Gould and *Erasuria* Heine, based upon them, respectively, are also synonyms of *Amazilia*. In fact, some other groups of species[*] which even Mr. Elliot has allowed to stand as genera come so very close to *Amazilia* in their structural and other characters that it may prove necessary to refer them also to the last-named genus.

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[*] Classification and Synopsis of the Trochilidæ, pp. 216–226.

The twelve species of *Amazilia* (as recognized by Mr. Elliot) found between the United States and Panama may be distinguished by the following characters:

COMMON CHARACTERS.—Above green, bronze-green, or bronzy; the tail rufous, chestnut, bronzy, purple, or blue-black; lower parts green anteriorly or entirely light cinnamon; sexes alike.

$a^1$. Lower parts partly green.
$b^1$. Belly pure white.
$c^1$. Tail purplish black. *Hab.* Costa Rica to Panama.
*A. niveoventer* (Gould). *White-bellied Humming Bird.*[†]
$c^2$. Tail deep bronze. *Hab.* Isthmus of Panama.
*A. edwardii* (De Latt. and Bourc.). *Edward's Humming Bird.*[‡]
$b^2$. Belly not white.
$c^1$. Tail blue-black or dark steel-blue.
$d^1$. Secondaries entirely black or blue-black. *Hab.* Nicaragua and Costa Rica.
*A. sophiæ* (Bourc. and Muls.). *Sophia's Humming Bird.*[§]
$d^2$. Secondaries rufous-chestnut, tipped with blue-black. *Hab.* Guatemala and Nicaragua (Pacific side).
*A. cyanura* Gould. *Blue-tailed Humming Bird.*[‖]
$c^2$. Tail bronzy, purple, or chestnut.
$d^1$. Tail greenish bronze. *Hab.* Eastern Mexico.
*A. ocai* Gould. *D'Oca's Humming Bird.*[¶]
$d^2$. Tail purple or chestnut.
$e^1$. Secondaries partly rufous.
$f^1$. Secondaries with more than basal half rufous; tail deep chestnut glossed with purple, the middle feathers purple. *Hab.* Southern Mexico.
*A. beryllina* (Licht.). *Berylline Humming Bird.*[**]
$f^2$. Secondaries with not more than basal half rufous; tail rich bronze-purple. *Hab.* Guatemala.
*A. maria* (Bourc.).[††] *Maria's Humming Bird.*
$e^2$. Secondaries without any rufous.
$f^1$. Belly and flanks dull brownish gray; lores deep rusty. *Hab.* South-eastern Texas to Ecuador.
*A. fuscicaudata* (Fras.). *Rieffer's Humming Bird.* (Page 366.)

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[*] For example: *Agyrtria* Reich., *Uranomitra* Reich., *Eucephala* Reich., *Timolia* Muls., *Arinia* Muls., and *Callipharus* Elliot.

[†] *Trochilus* (——?) *niveoventer* Gould, P. Z. S., 1850, 164. *Amazilia niveiventris* Elliot Class. and Synop. Troch., 1879, 222.

[‡] *Trochilus edwardi* De Latt. and Bourc., Rev. Zool., 1846, 308. *Amazilius edwardi* Bonap., Consp., I, 1850, 78.

[§] *Trochilus sophiæ* Bourc. and Muls., Ann. Soc. Lyons, IX, 1846, 318. *Amazilius sophiæ* Bonap., Consp., I, 1850, 78.

[‖] *Amazilia cyanura* Gould, Mon. Troch., pt. XVIII, 1850, pl. 12; vol. v, pl. 315.

[¶] *Amazilia ocai* Gould, Ann. Mag. N. H., ser. 3, IV, 1859, 96; Mon. Troch., v, 1861, pl. 289.

[**] *Trochilus beryllinus* Licht., Preis-Verz., 1830, No. 26. *Amazilia beryllina* Gould, Mon. Troch. pt. XXII, 1861 (vol. v, 1861, pl. 312).

[††] *Trochilus maria* Bourc., Ann. Soc. Ag. Lyon, IX, 1846, 319. *Amazilia mariæ* Elliot, Class. and Synop. Troch., 1879, 222.

$f^2$. Belly and flanks cinnamon-rufous or pale cinnamon; lores not distinctly rusty.

$g^1$. Belly and flanks deep cinnamon-rufous. *Hab.* Yucatan.

*A. yucatanensis* (CABOT). *Cabot's Humming Bird.*[*]

$g^2$. Belly and flanks pale cinnamon or cinnamon-buff. *Hab.* Eastern Mexico, north to southeastern Texas.

*A. cerviniventris* GOULD. Buff-bellied Humming Bird. (Page 364.)

$a^2$. Lower parts entirely cinnamon.

$b^1$. Smaller (wing 2.15–2.25, exposed culmen 0.80–0.88). *Hab.* Western Mexico and Yucatan to Nicaragua.

*A. cinnamomea* (LESS.) *Cinnamomeus Humming Bird.*[†]

$b^2$. Larger (wing 2.50–2.70, exposed culmen 0.90—1.05). *Hab.* Tres Marias Islands, western Mexico. *A. graysoni* LAWR. *Graysons Humming Bird.*[‡]

BUFF-BELLIED HUMMING BIRD. *Amazilia cerviniventris* GOULD.

*Amazilius cerviniventris* GOULD, P. Z. S., 1856, 150.

*Amazilia cerviniventris* GOULD, Mon. Troch., pt. XIII, 1857, pl. 12; vol. V, 1861, pl. 309.—MERRILL, Bull. Nutt. Orn. Cl., II, Jan. 1877, 26 (Ft. Brown, Texas).

*Amazilea yucatanensis* MERRILL and RIDGW., Pr. U. S. Nat. Mus., I, 1878, 148 (Ft. Brown, Texas; not *Trochilus yucatanensis* CABOT).

Fawn-breasted Amazili (GOULD).

Rufous-bellied Humming Bird (COUES).

L'Amazili à ventre de biche (MULSANT and VERREAUX).

Chupamirto de pecho verde y vientre castaño (D'OCA).

RANGE.—Eastern Mexico, north to the lower Rio Grande Valley, in Texas.

SP. CHAR.—*Adult (both sexes)*: Lores greenish or dull brownish (never rusty); belly and flanks pale dull cinnamon-buff; upper parts metallic bronze or bronze-green, the upper tail-coverts somewhat tinged with rusty on basal portion; tail rufous-chestnut (glossed with purple on the under surface), the feathers broadly tipped and margined terminally with metallic bronze; some specimens (immature specimens only?) with a considerable blackish subterminal space on one or both webs of all but the middle pair of feathers; chin, throat, and chest brilliant metallic Paris-green; breast metallic bronze-green; bill reddish (light brownish in dried skins), blackish terminally; length about 4.00–4.50; wing, 2.15–2.25; tail, 1.35–1.60, slightly emarginated; exposed culmen, 0.75–0.82. *Young* similar to adult, but upper mandible black, upper tail-coverts broadly margined with rusty, and tail-feathers (except middle pair) with a more or less extensive subterminal space of blackish on one or both webs, the median portion, however, including shaft, chestnut.

*Adult male* (No. 90749, Fort Brown, Texas, Dr. J. C. Merrill, U. S. Army): Above metallic green, tinged with bronze, the top of the head very much duller; upper tail coverts bronze-green, their basal portion

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[*] *Trochilus yucatanensis* CABOT, Proc. Nat. His. Soc., Bost., 1845, 74. *Amazilia yucatanensis* GOULD, Mon. Troch. pt. XXIII, 1861 (vol. V, 1861, pl. 308).

[†] *Ornismya cinnamomea* LESS., Rev. Zool., 1842, 175. *Amazilia cinnamomea* ELLIOT, Class. and Synop. Troch., 1879, 219.

[‡] *Amazilia (Pyrrhophæna) graysoni* LAWR., Ann. Lyc. N. Y., 1867, 404.

(partially exposed) dull cinnamon-rufous; tail clear chestnut, the two middle feathers broadly greenish bronze at tips (for about .28 of an inch along shaft and for a much greater distance along edges); rest of the tail-feathers similarly tipped with bronze, but this color gradually decreasing in extent to the outer pair, on the inner web of which the bronze is reduced to a very small angular space next to the terminal portion of the shaft; under surface of tail faintly glossed with purple; remiges dull brownish slate or dusky, faintly glossed with purplish. Sides of head metallic green, like hind neck, etc.; chin, throat, and chest brilliant metallic Paris-green; breast metallic bronze-green (extending farthest back laterally), the bases of the feathers dull grayish cinnamon; belly and flanks light, buffy cinnamon, the under tail-coverts vinaceous-cinnamon; downy femoral tufts white; short dense feathers clothing thighs and upper part of tarsus dull white, tinged with pale buffy-grayish. Upper mandible pale brown (reddish in life?), tipped with blackish for about 0.15 of an inch; lower mandible similar, but paler. Length (skin), 4.00; wing, 2.25; tail, 1.50, middle feathers 0.20 shorter; exposed culmen, 0.80.

*Young male* (No. 74337, Fort Brown, Texas, August 23, 1877; Dr. J. C. Merrill): Generally similar to the adult as described above, but upper parts much more golden bronze-green, feathers of lower back and rump margined terminally with dull light rusty and upper tail-coverts broadly margined with light rusty; middle tail-feathers with outer webs wholly dull metallic bronze, the terminal portion of both webs copper-bronze; other tail-feathers marked subterminally with purplish black, this reduced on outer feather to an edging to outer web, but on next to the middle pair occupying the greater portion of both webs near the tip; top of head dull blackish brown, passing into dull rusty brown laterally. Throat and chest not continuously brilliant green, but this color interspersed with patches of dull buffy and grayish-brown feathers. Upper mandible black, becoming brownish at base; lower pale brownish, blackish at tip.

*Young female* (No. 74339, same locality and collector, date not given): Similar to the young male as described above, but back, etc., purer (less bronzy) green, middle pair of tail-feathers wholly bronze (darker and more coppery terminally), purplish black subterminal spaces to other tail-feathers much more extensive and more distinct, belly and flanks much duller and grayer buffy, and only the basal half of the under mandible light colored.

This bird is so closely related to the *A. yucatanensis* (Cabot) of Yucatan that there is a strong probability that it will prove to be merely a race of the same species. Although the type of *A. yucatanensis* exhibits some characters of plumage which I have not been able to recognize in any of the examples of *A. cerviniventris* which I have been able to examine,* additional specimens show these differences to be inconstant and therefore not diagnostic, thus reducing the differential characters of the two forms to the coloration of the under parts alone, *A. yucatanensis* having the breast, belly, sides, flanks, and under tail-coverts much deeper in color, or a clear deep cinnamon-rufous, the absence of any distinct wash of bronze-green on the sides of the breast rendering the contrast between the brilliant green of the throat and chest and the cinnamon-rufous color which follows it much more abrupt and conspicuous.

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* See Proceedings of the U. S. National Museum, Vol. IV, pp. 25, 26.

The Buff-bellied Humming Bird, the plainest species of the family that has hitherto been added to our fauna, was first obtained within our limits by Dr. J. C. Merrill, U. S. Army, at Fort Brown, Texas, in 1876. It was there an abundant summer visitor, being particularly numerous on the military reservation. It seemed to be perfectly at home among the dense tangled thickets, darting rapidly among the bushes and creeping vines, and was so active that specimens were obtained with difficulty. It was rather a noisy bird, its shrill cries usually first attracting attention to its presence.*

Mr. George B. Sennett met with it at the same place the following year, but only obtained one specimen, which was shot while hovering over wild flowers near the ground, among cacti and low bushes.†

I am unable to add anything further regarding its habits.

### RIEFFER'S HUMMING BIRD. *Amazilia fuscicaudata* (FRASER).

(Plate XLIII.)

*Trochilus fuscicaudatus* FRAS., P. Z. S., 1840, 17 (Ecuador).
*Amazilia fuscicaudata* MERRILL and RIDGW., Pr. U. S. Nat. Mus., I, Oct., 1878, 147 (Fort Brown, Texas).
*Trochilus riefferi* BOURC., Ann. Sci. Phys. et Nat. Lyon, 1843, 45.
*Amazilia riefferi* REICH., Av. Syst. Nat., 1849, pl. 39.—GOULD, Mon. Troch., pt. XIX, 1860, pl. 14; vol. V, 1861, pl. 311.
*Pyrrhophæna riefferi* CAB. and HEINE, Mus. Hein., III, 1860, 36.—MERRILL, Bull. Nutt. Orn. Cl., I, Nov., 1876, 88 (Fort Brown, Texas).
Rieffer's Amazili (GOULD).
Dusky-tailed Humming Bird (COUES).
L'Ariane de Rieffer (MULSANT and VERREAUX).

RANGE.—The whole of Central America and eastern Mexico; north to the lower Rio Grande Valley in Texas; south to Ecuador.

SP. CHAR.—Lores rusty; breast and belly pale brownish gray; upper parts metallic bronze-green, darker on top of head, more bronzy or golden on rump; tail deep chestnut, including middle feathers, the feathers tipped and margined more or less extensively with bronze or purplish; throat and chest brilliant metallic yellowish green, the feathers pale grayish beneath the surface, showing wherever the feathers are disarranged; sides and flanks bronze-green; under tail-

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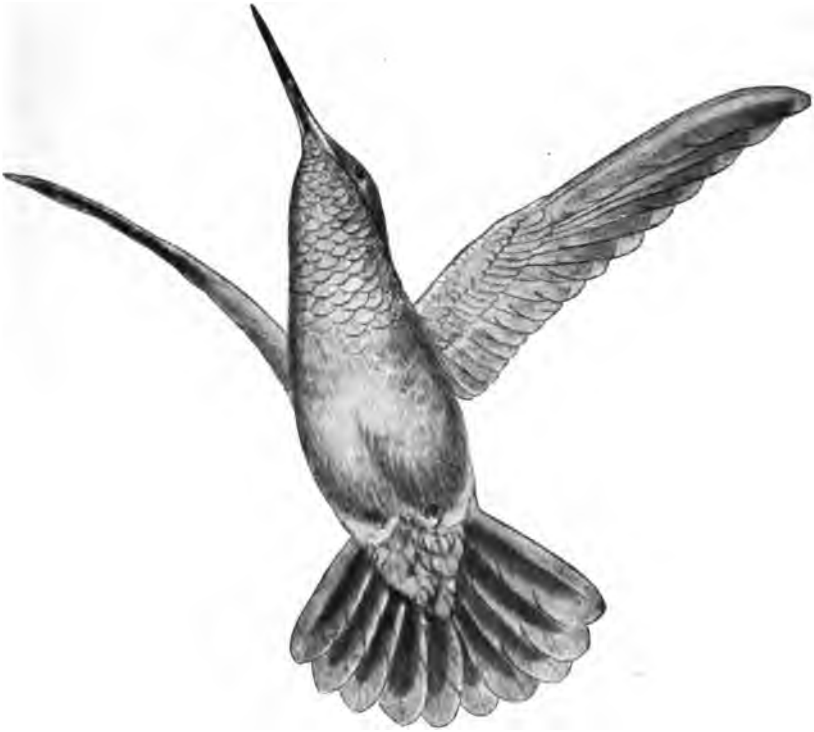
* Pr. U. S. Nat. Mus., Vol. I, 1879, pp. 149, 150.

† Bull. U. S. Geol. & Geog. Surv. Terr., Vol. IV, No. 1, p. 36.



RIEFFER'S HUMMING BIRD (*Amazilia fuscicaudata*).
Male. (Cat. No. 50870, U. S. N. M. Guatemala City, Guatemala. Collected by Dr. Van Patten.)

coverts chestnut-rufous; anal and femoral downy tufts white; bill reddish at base for a greater or less distance (brownish in dried skins), the terminal portion black; length (skins), about 3.80–4.35; wing, 2.00–2.40; tail, 1.45–1.70; exposed culmen, 0.70–0.90. *Adult female* similar to the male, but usually more or less duller in color. *Young* similar to adults, but plumage duller, the rump more tinged with rusty, and the head washed with rusty.

*Adult male* (No. 50370, Guatemala City, Guatemala; Dr. Van Patten): Above metallic bronze-green, more decidedly bronzy, but also darker and duller, on top of head, the rump inclining to golden bronze; upper tail-coverts and tail, including middle pair of feathers, chestnut, the latter glossed with purple (especially underneath), and each feather broadly margined terminally with deep bronze, this color also edging the outer webs; remiges dull brownish slate or dusky, faintly glossed with purplish. Lores deep rusty; chin, malar region, throat, and chest brilliant metallic yellowish green, somewhat broken by the light grayish brown basal portion of the feathers here and there exposed; sides and flanks metallic bronze-green; median portion of breast and belly light grayish brown; femoral and anal tufts white; under tail-coverts light chestnut. Upper mandible brown (reddish in life), tipped and edged with blackish; under mandible brownish white (red or flesh-colored in life), with tip dusky; feet dusky. Length (skin), 3.80; wing, 2.30; tail, 1.40 (middle feathers 0.05 shorter); exposed culmen, 0.78.

*Adult female* (No. 38987, Panama, January 7, 1865; Fred. Hicks): Similar to the male, as described above, but tail and its coverts rather lighter chestnut; belly much lighter brownish gray, and bill more extensively dusky. Length (skin), 3.80, wing, 2.10; tail, 1.35; exposed culmen, 0.85.

*Young female* (No. 40452, San Juan, Nicaragua, June 7, 1865; H. E. Holland): Similar to the adult, but duller green above, with feathers of the lower back and rump broadly margined with rusty; anterior lower parts with green much less brilliant and much interrupted by dull brownish gray, approaching grayish white on the chin. Upper mandible entirely blackish.

With very numerous specimens before me, representing various localities, from eastern Mexico to Bogota, I am unable to discover any constant differences coincident with locality, even in specimens from the most remote districts. There is a considerable range of individual variation, involving the amount of blackness of the maxilla (some specimens having the upper mandible wholly blackish except the extreme base, while in others only the end is dark-colored), length of wing and bill, etc. These differences, however, appear to be purely individual, and not at all, so far as I can see, local. Some Costa Rican specimens are the largest in the collection, as well as the darkest in color, but there is much variation in both respects in a series of 8 examples from that country.

A specimen from Guayaquil, Ecuador, however, (No. 54961, Dr. Destruge) labeled by M. Lawrence "*riefferi* var. *jacunda*," on the other hand, differs decidedly from all more northern examples, including those from Colombia, in the very much lighter color of the tail-coverts, tail, and abdomen, the latter being very nearly white, instead of brownish gray or grayish brown.

Like the allied Buff-bellied Humming Bird, Rieffer's Humming Bird was first taken within the United States by Dr. J. C. Merrill, U. S. Army, who examined a living specimen brought to him by a soldier at Fort Brown, but which subsequently escaped. Fortunately, however, Dr. Merrill had taken a careful description of the bird while in his possession, so there can be no question as to the correct identification of the species.

But little has been recorded of the habits of this species, the following, from Gould's monograph, being all that I have been able to find:

> Mr. Bridges found it feeding on a Malvaceous plant near the Boqueti, at an elevation of 4,000 feet; Mr. Salvin met with it at Coban in November, and also near Bezbal, and remarked that it was far from common at Coban, and that all the specimens he procured appeared to be males; and Mr. Fraser noticed it feeding from the bark of a large tree in the forest of Bababoyo in Ecuador, and states that when he arrived in Esmeraldas in October it was by no means uncommon, feeding morning and evening around the eaves of the house; in November it was very scarce, and in December not to be seen.

### GENUS **BASILINNA** BOIE.

*Basilinna* BOIE, Isis, 1831, 546. Type, *Trochilus leucotis* VIEILL.
*Heliopædica* GOULD, Mon. Troch., pt. XV, 1858. Type, *Trochilus melanotis* SWAINS., = *T. leucotis* VIEILL.

GENERIC CHARACTERS.—Similar to *Amazilia*, but bill broader, and more denuded at the base, the frontal apex being considerably posterior to the mental apex, and sexes very different in coloration.

This genus is so closely related to *Amazilia* that the sexual difference in coloration is the most obvious difference. Only two species are known, their diagnostic characters being as follows:

COMMON CHARACTERS.—Above metallic green, darker or duller on top of head; tail mainly chestnut or blackish, the middle feathers, however, with more or less green; a broad and very conspicuous white stripe behind eye, with a black, dusky, or brownish one immediately beneath it, across ear-coverts. *Adult males* with forehead and chin black or deep blue, the throat and upper part of chest brilliant metallic green. *Adult females* with top of head dull brownish (sometimes tinged with green), and lower parts pale cinnamon (with or without green spots on throat) or dull grayish white with sides green.

$a^1$. Tail mainly chestnut; posterior lower parts pale cinnamon. *Adult male:* Forehead and chin opaque black, or dull blue-black; middle tail-feathers chestnut centrally, metallic green exteriorly, the rest without dusky subterminal bar or spot. *Adult female:* Lower parts pale cinnamon, with or without green spots on throat; middle tail-feathers entirely green, the rest marked by a more or less distinct subterminal spot of dusky. *Hab.* Southern portion of Lower California. *B. xantusi* (LAWR.). *Xantus's Humming Bird.* (Page 369.)

$a^2$. Tail mainly blackish; posterior lower parts dull whitish, mixed with grayish brown and greenish. *Adult male* with forehead and chin deep rich blue; middle tail-feather entirely metallic green or bronze, the others tipped with green or bronzy. *Adult female:* Lower parts dull light grayish, or grayish white, more or less spotted with green, the sides almost continuously of this color; middle tail-feathers entirely green or bronzy, the others black, the two or three outer ones tipped with dull grayish. *Hab.* Highlands of Guatemala and Mexico. *B. leucotis* (VIEILL.). *White-eared Humming Bird.*[*]

### XANTUS'S HUMMING BIRD. *Basilinna xantusi* (LAWR.).

(Plate XLIV.)

*Amazilia xantusi* LAWR., Ann. Lyc. Nat. Hist. N. Y., VII, April, 1860, 109 (female).
*Heliopædica xantusi* GOULD, Mon. Troch., pt. XXI, 1861, pl. 2; vol. II, 1861, pl. 65.—COOP., Orn. Cal., I, 1870, 365.—B. B. and R., Hist. N. Am. B., II, 1874, 467, pl. 47, fig. 3.
*Basilinna xanthusi* ELLIOT, Class. and Synop. Troch., 1879, 227.
*Basilinna xantusi* RIDGW., Pr. U. S. Nat. Mus., III, 1880, 6, 188.
*Heliopædica castaneocauda* LAWR., Ann. Lyc. Nat. Hist. N. Y., VII, Apr., 1860, 145 (male).—ELLIOT, Illustr. B. N. Am., I, 1869, p. XXII.
Le Coeligène de Xanthus (MULSANT and VERREAUX).
Chupamirto de pico coral y vientre castaño (D'OCA).

RANGE.—Cape district of Lower California.

SP. CHAR.—Tail mainly chestnut; posterior under parts pale cinnamon-rufous. *Adult male* with forehead and chin opaque black or dull blue-black, throat and chest brilliant metallic yellowish green, and a broad, white stripe behind eye; length (skins), about 3.40–3.60;[†] wing, 1.95–2.15; tail, 1.35–1.40; exposed culmen, 0.65–0.70. *Adult female* without any black about head, the white post-ocular stripe less distinct, and the entire under parts light cinnamon-rufous; length (skins), about 3.10–3.50;[‡] wing, 1.85–2.00; tail, 1.15–1.25; exposed culmen, 0.60–0.70.

*Adult male* (No. 117767, Miraflores, Lower California, November 29, 1859; J. Xantus):[§] Forehead slightly glossy blue-black, changing gradually into duller blackish on the crown; chin and a broad stripe thence beneath eye to ear-coverts opaque, velvety black; lores dull grayish white; behind the eye a distinct stripe of white, changing into light cinnamon-grayish on side of neck; occiput, hind-neck, wing-coverts, scapulars, and back, metallic bronze-green; upper tail-coverts bronze-green mixed with rusty; tail chestnut, faintly glossed with purple on under surface, the middle pair of feathers broadly margined with metallic bronze-green; remiges dusky brownish slate, very faintly glossed with purplish. Throat and upper part of chest brilliant metallic yellowish emerald-green or Paris green; feathers of lower chest and breast metallic bronze-green terminally, light cinnamon-rufous basally; rest of under parts light cinnamon-rufous, the anal region and under tail-coverts paler. Bill with basal half or more pale brownish (coral-red in life), the terminal portion blackish. Length (skin), 3.40; wing, 2 05; tail, 1.40; the middle feathers, about 0.10 shorter; exposed culmen, 0.65.

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[*] *Trochilus leucotis* VIEILL., Nouv. Dict., ed. 2, XXII, 1818, 428. *Basilinna leucotis* REICH., Aufz. der Colib., 1853, 13.

[†] Length of a specimen before skinning said to be 4.75.

[‡] Length before skinning said to be 3.30–3.65.

[§] Type of *Heliopædica castaneocauda*, LAWR.

*Adult female* (No. 16935, Cape St. Lucas, Lower California, October 1859; J. Xantus):* Sides of forehead dull cinnamon-rufous; median portion of forehead, with crown, dull grayish brown; rest of upper parts, including middle pair of tail-feathers, metallic bronze-green, the upper tail-coverts margined and somewhat mixed with rusty; tail-feathers (except middle pair) chestnut, becoming gradually paler on the outermost, the second and third (from the middle) with a large blackish longitudinal subterminal spot on each web, the fourth with a similar spot on the inner web and a trace of such a spot on the outer; outermost feather without any spot on the outer web, and with a mere speck of blackish on the inner web; remiges dull brownish slate or dusky, faintly glossed with purplish. A distinct stripe of buffy whitish behind eye, above upper margins of the ear-coverts, the latter dusky grayish brown; chin, throat, and other lower parts dull cinnamon-rufous, becoming paler and somewhat mixed with whitish posteriorly. Upper mandible black, becoming more brownish at base; lower pale brownish (reddish in life), with blackish tip. Length (skin), 3.10; wing, 1.85; tail, 1.20, the lateral feathers about 0.10 shorter; exposed culmen, 0.60.

Among adult males the principal variation in color affects the green of the throat, which may be a decidedly yellowish green or a nearly pure emerald-green, and the extent of bronze-green on the middle tail-feathers, which sometimes covers the entire outer web and the greater part of the inner web also.

Adult females obtained during midsummer are much paler, the color of the lower parts being a dull grayish buff, and the post-ocular stripe quite white.

A specimen, labeled "Mazatlan, Mexico" (No. 24853, J. Xantus), is similar to Lower California specimens and is doubtless not from the ascribed locality.

What appears to be an adult female, but may be an immature male (No. 24855, Cape St. Lucas, April, 1860, J. Xantus), differs from the usual plumage of the adult female in having a quite extensive patch of metallic yellowish green covering nearly the whole of the throat, and some blackish feathers in the region extending from the side of the chin to the ear-coverts.

What little we know of the habits of Xantus's Humming Bird is due to Mr. L. Belding who observed it at several localities in the southern part of Lower California, where he informs us it is a mountain-loving species, and usually to be found near fresh water, while in winter he found it only in the mountain cañons. "It was common at the western

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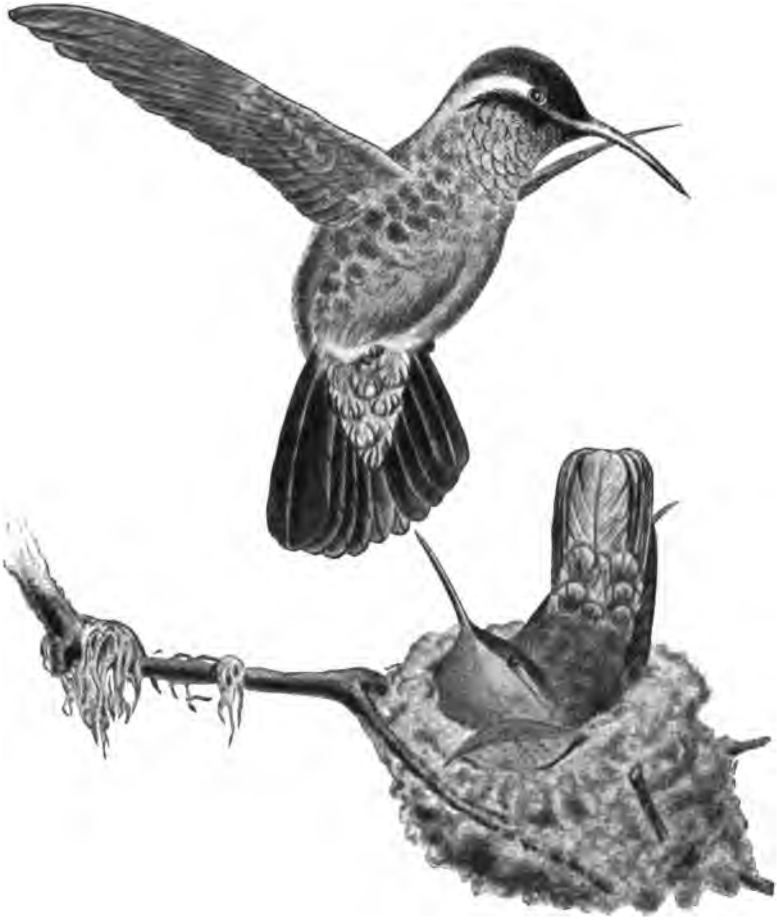
* Type of *Amazilia xantusi*, LAWR.



XANTUS'S HUMMING BIRD (*Basilinna xantusi*).

**Male.** (Cat. No. 113101, U. S. N. M. Pierce's Ranch, Lower California. Collected by M. A. Frazar.)

Female. (Cat. No. 113104, U. S. N. M. Pierce's Ranch, Lower California. Collected by M. A. Frazar.)

Nest. (Cat. No. 18563, U. S. N. M. San José, Lower California. Collected and presented by L. Belding.)

base of Cacachiles Mountain in February; more so, in fact, than *C. costæ*. It was not observed at San José until some time after my arrival, though it occurred in cañons only 2 or 3 miles to the westward. About the last of April it was common in orchards at San José.

"While incubating, this species is very confiding and courageous, sometimes remaining upon the nest until removed from it by the hand. A nest taken April 23 was placed underneath an awning or shade of boughs and weeds in front of a farmhouse. It was surrounded by downy heads of composite plants and could scarcely be distinguished from them, having as usual, been made of raw cotton."

The two nests of this species obtained by Mr. Belding are very neat structures, quite different in appearance from the nest of any other North American Hummer, though they differ much from one another. The finer of the two (No. 18563, San José, April 23,) is a compactly felted mass composed chiefly of raw cotton, but this coated exteriorly with spiders' webs and light brown fine fibrous materials. It is securely fastened to two forks of a twig and rests between them. The shape is very irregular, owing to the manner in which it is secured to the twigs, but on top the transverse diameter is about 1.50 inches, the cavity being about 1 inch across and about 0.60 of an inch deep. The two eggs measure respectively 0.32 by 0.50 and 0.34 by 0.49, being essentially identical in size and shape with those of *Calypte costæ*, from which it is apparently quite impossible to distinguish them. The other nest (No. 18564, Arroyo, north of Santiago Peak, May 9) is quite different both in shape and material. It is very regularly but shallowly cup-shaped, averaging a little over 1.50 inches in external diameter, but only about 0.80 of an inch in extreme height. The cavity is about 1 inch across by a little over 0.50 of an inch in depth. The material is chiefly raw cotton, but this much mixed, especially outwardly, with fine leaf-stems, seed-capsules, spiders' webs, etc., besides one or two soft white feathers. Like the other nest, this one is supported between two twigs. The eggs measure respectively 0.34 by 0.49 and 0.32 by 0.50.

### Genus **IACHE** Elliot.

*Circe* Gould, Mon. Troch., pt. xiii, May 1, 1857. Type, *Cynanthus latirostris* Swains. (Preoccupied; Mert., 1835, Acal.)

*Iache* Elliot, Class. and Synop. Troch., March, 1879, 234. Type, *Cynanthus latirostris* Swains.

Generic characters.—Similar to *Chlorostilbon* Gould,* but bill longer. Bill decidedly longer than head, nearly or quite straight, the nostrils entirely uncovered by feathers, though overhung by a conspicuous operculum; the length of the exposed culmen equaling or exceeding the distance from the bend of the wing to the tips of the longest secondaries; tail deeply emarginate, the longest (lateral) feathers about equal in length to the distance from the tips of the longest secondaries to that of the longest primary, the shortest (middle) feathers less than half as long as the wing. (Female with lateral rectrices shorter, and tail therefore less deeply emarginated.) *Adult males* metallic grass-green above, the tail-feathers blue-black with dull gray tips (broadest on middle feathers); downy thigh-tufts pure white; under tail-coverts with more or less of white; rest of lower parts metallic green, bluish green, or blue; bill pale brownish (red in life) on basal portion, blackish at end. *Adult females* metallic grass-green above, pale grayish beneath, the two exterior tail-feathers tipped with pale brownish gray, and all with the basal half green.

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* *Chlorostilbon* Gould, Mon. Troch., pt. v, 1853; Introd. Troch., oct. ed., 1861, 175. Type, *Trochilus pucherani* Bourc. and Muls.

This genus comes so very close to *Chlorostilbon* that I am unable to give satisfactory characters for its separation; indeed, some of the Central American species of *Chlorostilbon* resemble the species of *Iache* quite as much, both in coloration and form, as the type of the former genus (*C. pucherani*). In fact, I am unable to see why the two so-called genera, together with *Riccordia* REICH.,* of the Bahamas, Cuba, Haiti, and Porto Rico, should not be merged into one genus.

The number of species embraced in the so-called genus *Iache* is very uncertain, only two of the five which have been described possessing very definite characters. I have at this moment before me the types of *I. magica* (Muls. and Verr.) and *I. doubledayi* (Bourc.), besides typical specimens of *I. lawrencei* Berl., a good series of *I. latirostris* (Sw.), and a fine adult male of what should be, from the locality, the *I. nitida* of Salvin. The five names above mentioned belong to two quite distinct groups, *I. magica* and *I. lawrencei* being closely related to *I. latirostris*, while *I. nitida* is allied to *I. doubledayi*. Of the latter group I have only three specimens for comparison, all adult males, as follows: The type of *I. doubledayi*, kindly lent by the American Museum of Natural History in New York City; a specimen from Tehuantepec, collected by Professor Sumichrast (No. 57794, U. S. National Museum), and referred by Mr. Lawrence to *I. doubledayi*; and a most perfect example collected by Mr. O. T. Baron, at Dos Arroyos, State of Guerrero, Mexico, the region from which Mr. Salvin's recently described *I. nitida* was obtained. These three specimen are so much alike, however, that I have little hesitation in referring them to one species, especially the first and last, the Tehuantepec specimen being much more different from the other two than they are from one another. I am therefore not able to decide, without more specimens, how many forms of the *doubledayi* group should be recognized, but would not be much surprised if *I.*

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* *Riccordia* REICH., Aufz. der Colib., 1853, 10. Type, *Trochilus riccordi* GERV.—*Sporadinus* BONAP., Rev. et Mag. Zool., 1854, 255. Same type.

This so-called genus embraces four species, as follows: *R. riccordi* (GERV.), of Cuba and two of the Bahama islands (Andros and Abaco); *R. bracei* (LAWR.) from New Providence, Bahamas; *R. elegans* (VIEILL.), from Haiti, and *R. maugæi* (VIEILL.), from Porto Rico.

*nitida* would eventually prove to be merely a variation of *I. doubledayi*, and not a distinct species.

The males of the several forms may be distinguished as follows, the females of all except *I. latirostris* and *I. nitida* being unknown to me:

*a*¹. Tail forked for only one-fourth its total length; exposed culmen more than .70.

*b*¹. Upper parts bronze-green; bill larger and broader at base.

c¹. Under tail-coverts white, with dull grayish central spaces, entirely white in young; whole throat metallic blue. *Hab.*, Western and central Mexico, north to southern Arizona.

*I. latirostris* (SWAINS.). *Circe Humming Bird* (Page 373).

c². Under tail-coverts dusky grayish, glossed with green, margined with grayish white; throat metallic green, tinged with blue toward chin. *Hab.* Tres Marias Islands, western Mexico.

*I. lawrencei* BERL. *Lawrence's Humming Bird* [*]

*b*². Upper parts purplish copper-bronze; bill smaller and narrower (exposed culmen less than 0.75, width at base not over 0.12). *Hab.*, Western Mexico (vicinity of Mazatlan). *I. magica* (MULS. and VERR.). *Magic Humming Bird.*[†]

*a*². Tail forked for much more than one-fourth its total length; exposed culmen less than 0.70.

*b*¹. Under parts, except throat, metallic bluish green; top of head metallic emerald-green, inclining to blue on forehead. *Hab.*, Southwestern Mexico (Dos Arroyos, Guerrero; "Chimantla").

*I. doubledayi* (BOURC.). *Doubleday's Humming Bird.*[‡]

*b*². Under parts metallic blue, the throat more purplish blue; top of head metallic blue, more greenish posteriorly. *Hab.*, Southwestern Mexico (Sierra Madre of Guerrero; Chihuitan, Tehuantepec).

*I. nitida* SALV. *Shining Humming Bird.*[§]

### CIRCE HUMMING BIRD. *Iache latirostris* (SWAINS.).

(Plate XLV.)

*Cynanthus latirostris* SWAINS., Philos. Mag., I, 1827, 441.
*Circe latirostris* GOULD, Mon. Troch., pt. XIII, 1857, pl. 7; vol. V, 1861, pl. 338.—HENSH., Am. Sportsm., V, Feb. 20, 1875, 328 (Chiricahua Mountains, Arizona); Zoöl. Wheeler's Exp., 1875, 380.
*Iache latirostris* ELLIOT, Class. and Synop. Troch., 1879, 235.
Circe (GOULD).
Broad-billed Humming Bird.
La Circé à large bec (MULSANT and VERREAUX).
Chupamirto matraquita (D'OCA).

RANGE.—Western and central Mexico, north into southern Arizona.

SP. CHAR.—*Adult male*, metallic bronze-green above, much duller on top of head, and on upper tail-coverts; tail blue-black, the middle feathers tipped with brownish gray; chin and throat bright metallic blue, rest of under parts metallic green, the under tail-coverts white, with or without grayish or greenish central spots; bill reddish basally (brownish in dried skins), black terminally; length, dried skins, 3.40–3.65; before skinning, 3.75–4.10;[*] wing, 1.95–2.08; tail, 1.20–1.35 (forked for 0.25–0.40), exposed culmen, 0.75–0.87. *Adult female*, metallic green, or bronzy-green above, becoming dull brownish gray on forehead; middle tail-feathers metallic green or bluish green, usually shaded with blue-black terminally or subterminally, the other tail-feathers greenish basally, then blue-black, their tips brownish gray (much broadest on exterior feather); lower parts light brownish gray, more or less washed with metallic green on sides of breast; a white spot or short streak behind eye; length, dried skins, about 3.25–3.40; before skinning, about 3.95[†]; wing, 1.90–2.10; tail, 1.15–1.20 (forked for about 0.12–0.25); exposed culmen, 0.75–0.87.

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[*] *Iache lawrencei* BERL., RIDGW., Man. N. Am. B., 1887, 320.

[†] *Hylocharis magica* MULS. and VERR., Ann. Soc. Lyon, XVIII, 1872, 110.—*Iache magica* ELLIOT, Class. and Synop., Troch., 1879, 235.

[‡] *Trochilus doubledayi* BOURC., P. G. S., 1874, 46.—*Iache doubledayi* ELLIOT, Class. and Synop. Troch., 1879, 235.

[§] *Iache nitida* SALV., Ibis, April, 1889, 240.

*Adult male* (No. 99218, Santa Rita Mountains, Arizona, June 28, 1884; E. W. Nelson): Above metallic grass-green (some of the feathers tinged with bluish green in certain lights), the forehead much duller; remiges dull brownish slaty, very faintly glossed with purplish; upper tail-coverts metallic bluish green; tail glossy blue-black, the four middle feathers tipped with dull brownish gray, this about .10 of an inch wide on middle pair. Chin and throat rich metallic cobalt-blue, gradually changing posteriorly to metallic bluish grass-green, which color covers uniformly the chest, breast, belly, sides, and flanks; thigh tufts pure white; under tail-coverts white on edges (broad), pale brownish gray medially. Bill light brownish (red or flesh-colored in life), about the terminal third blackish; feet dusky, Length, dried skin, 3.50; wing, 2.05; tail, 1.30 (forked for 0.25); exposed culmen, 0.87.

*Adult female* (No. 111646, Tucson, Arizona, April 22, 1884; E. W. Nelson): Above metallic green, glossed with bronze, changing to dull brownish gray on top of head, and to a more bluish green on upper tail-coverts and two middle tail-feathers; outer tail-feathers brownish gray, crossed by a broad subterminal band of blue-black, about .30 of an inch wide along shaft and removed about the same distance from the tip; the terminal gray space somewhat paler than the basal one; next feather has the basal gray space glossed with bluish green and the terminal gray space much reduced in size, forming a triangular spot; third feather has the basal portion metallic bluish green, and the terminal gray spot still smaller; fourth similar, but with merely a slight terminal edging of grayish; remiges dusky brownish slate, very faintly glossed with purplish. Chin, malar region, throat, chest, breast, belly, sides, and flanks plain light brownish gray, the sides of the breast washed with metallic green and the flanks tinged with brownish; under tail-coverts white, the shorter feathers tinged with brownish gray. An oblique broad postocular streak of dull white, immediately above the ear-coverts, the latter dusky. Upper mandible black; lower brownish

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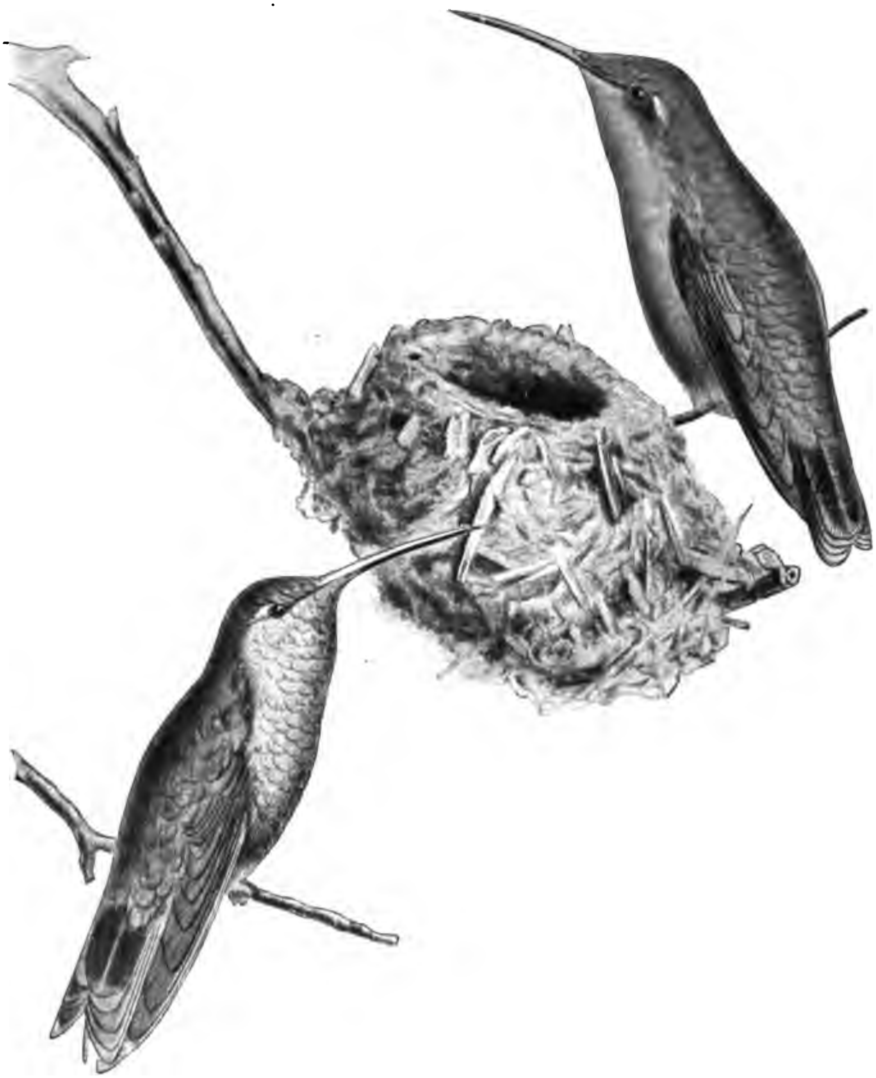
[*] Extent of wings, 4.98–5.05.

[†] Extent of wings, 5.05.



CIRCE HUMMING BIRD (*Iache latirostris*).
Male. (Cat. No. 99219, U. S. N. M. Santa Rita Mountains, Arizona. Collected by E. W. Nelson.)
Female. (Cat. No. 99220, U. S. N. M. Santa Rita Mountains, Arizona. Collected by E. W. Nelson.)
Nest. (Cat. No. 17890, U. S. N. M. Guanajuato, Mexico. Collected and presented by Prof. A. Dugès.)

(reddish in life), tipped with dusky. Length, skin, 3.50; wing, 2.05; tail, 1.20 (forked for about 0.12); exposed culmen, 0.87.

*Young male, transition plumage* (No. 99730, Arizona; E. W. Nelson): Above metallic green (much duller than in the adult), the feathers of the lower back and rump and the upper tail-coverts indistinctly margined at tips with dull pale brownish; tail as in adult male; under parts as in adult female, but chin, throat, and malar region inclining to light broccoli-brown, the latter interspersed with metallic greenish blue feathers (of the adult livery), the chest also mixed with metallic green feathers.

*Young female* (No. 72536, Santa Rita Mountains, Arizona, Aug. 24, 1874; H. W. Henshaw): Similar to the adult female, but feathers of the back, rump, etc., margined terminally with pale brown, these edgings most distinct posteriorly; under parts tinged with light brown, especially the chin, malar region, and throat.

Among adult males the principal variation is in the coloration of the under tail-coverts, which may be white, with the anterior or shorter feathers merely shaded with pale brownish gray, or marked with distinct median spaces of deep brownish gray, an intermediate coloration being the rule. The color of the throat varies slightly in the shade of the blue, which sometimes has a more decided greenish cast, and the upper tail-coverts may be of the same color as the back or of a decidedly darker and duller hue.

The specimens examined are from the valley of Mexico, the plains of Colima, the vicinity of Mazatlan, and southern Arizona.

The Circe Humming Bird is a common species of western and central Mexico and is a more or less common summer resident in suitable portions of southern Arizona, where it was first found in the Chiricahua Mountains, in 1874, by Mr. H. W. Henshaw, and where, both in the original and other localities, it has subsequently been found by other collectors.

It was next met with in the Santa Rita Mountains by Mr. F. Stephens, as recorded by Mr. Brewster in The Auk, vol. VII, 1882, p. 211; then in the Santa Catalina range by Mr. W. E. D. Scott, in 1884.

> Of this curious rather than beautiful Humming Bird [says Mr. Henshaw*] three specimens were secured in the Chiricahua Mountains, at a point a few miles distant from Camp Crittenden. As the breeding season was entirely passed, I was able to note nothing concerning its habits which served to distinguish it from others of the family, save what appeared to be a constant habit of frequenting the agaves; and all the specimens were shot as they were flying about these peculiar plants, in the neighborhood of which I am confident I saw several others. Great numbers of this species are found in Mexico; and, as they there inhabit the mountains and table-lands, the species doubtless extends in summer through northern Mexico, and finds in the extreme southern parts of Arizona a suitable climate; while an abundance of the agave, to which plants it resorts in its more tropical home for at least a great portion of its subsistence, serves as a further attraction. No doubt these hummers are quite numerous in the locality I have referred to earlier in the season, as well as in other similar places.

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* Zoölogy of Wheeler's Survey, 1875, p. 381.

Mr. F. Stephens subsequently found the Circe Humming Bird in the Santa Rita Mountains, where five specimens were obtained and others seen. They were always found near water, and usually along the streams which flowed through cañons, high among the mountains. They seemed to prefer sycamores to other trees, and invariably perched on dead twigs where they could command an open view. Their notes were flat and differed from those of other Hummers.*

The Santa Catalina Mountains were afterward added to their range by Mr. W. E. D. Scott, who thus records his observations:

> During the spring, summer, and early fall of 1884 this was a rather common species in the Catatina Mountains, from an altitude of 3,500 to 5,000 feet, but in the corresponding season of 1885 the birds were apparently rare. The birds arrive at this point early in April, the 5th of that month being my earliest record, when I took two adult males. They remain throughout the spring and summer, leaving from the middle to that last of September. I took an adult female on June 26, 1884, that contained an unlaid egg with shell nearly formed, so that there can be but little doubt that the birds breed at this point. Besides, I have the young birds in first plumage from July 1 until late in August.†

## SPECIES WHICH HAVE BEEN WRONGLY ADMITTED TO THE NORTH AMERICAN FAUNA, OR WHICH ARE PURELY ACCIDENTAL STRAGGLERS.

The following species have been given in works on North American birds, but are properly not entitled to a place in our fauna. One of them (*Atthis heloisa*), being a bird of eastern Mexico, will doubtless yet be found in southern Texas, but the other two belong to regions far beyond our limits.

### Genus **LAMPORNIS** Swainson.

*Lampornis* Swains., Zool. Jour., III, 1827, 358. Type, *Trochilus mango* Linn.

*Anthracothorax* Boie, Isis, 1831, 546. Type, *Trochilus nigricollis*, Vieill.

*Smaragdites* Boie, Isis, 1831, 547. Type, *Trochilus dominicus* Linn.

*Floresia* Reich., Aufz. Colib., 1853, 11 (subgenus). Type, *Trochilus porphyrurus* Shaw, = *T. mango* Linn.

*Hypophania* Reich., Aufz. Colib., 1853, 11 (subgenus). Type, *Trochilus dominicus* Linn.

*Margarochrysis* Reich., Aufz. Colib., 1853, 11. Type, *Trochilus aurulentus*, Vieill. = *T. dominicus* Linn.

*Endoxa* Heine, J. f. O., 1863, 179. Type, *Trochilus porphyrurus* Shaw. (Substitute for *Floresia* Reich!.)

Generic characters.—Size large (wing, 2.50 or more); tail large, slightly rounded, double rounded, or emarginate, considerably more than half as long as wing, the feathers broad, with rounded tips, their color mainly chestnut, glossed with purple, or bright purple (blackish green in *L. viridis*); wing ample, the primaries of normal shape; bill longer than head, slightly curved, its vertical thickness least through the middle; nasal opercula partly feathered; greater part of tarsi naked.

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*Brewster, the Auk., vol. VII, p. 211.

†The Auk, vol. III, 1886, p. 432.

The species of *Lampornis* are about ten in number (including subspecies), and belong chiefly to the West Indies and the Atlantic coast district of tropical America; four of them, *L. dominicus* (Linn.), *L. viridis* (Vieill.), *L. mango* (Linn.), and *L. ellioti* Cory, are restricted to the West Indies; the same number are continental; one which is merely an insular race of a continental species is confined to the Caribbean island of Old Providence, while one (*L. calosoma* Elliot) is of unknown habitat.

The Central American forms may be distinguished by the following characters:

COMMON CHARACTERS.—Adult males bronze-green above; tail (except middle feathers) bright chestnut-purple, glossed with violet-purple, the feathers margined terminally with blue-black; lower parts greenish, with or without a broad black throat-stripe. *Adult females* with lower parts mainly white, but with a median stripe (broadest on throat) of black or green; tail-feathers (except middle pair) bluish or greenish black termially or subterminally, their tips often white.

$a^1$. Throat-stripe opaque velvety black.
  $b^1$. Black of throat continued backward to belly. *Hab.*, Panama to Brazil.
    *L. nigricollis* (VIEILL.). *Black-throated Humming Bird* (Page 377.)
  $b^2$. Black of throat not extending beyond chest.
    $c^1$. Bill longer (culmen 0.90 or more). *Hab.*, Southern Mexico to Costa Rica.
      *L. prevosti* (LESS.). *Prevost's Humming Bird.**
    $c^2$. Bill shorter (culmen, 0.78). *Hab.*, Old Providence Island, Caribbean Sea.
      *L. prevosti hendersoni* (CORY). *Henderson's Humming Bird.*†
$a^2$. Throat-stripe (female) or whole throat (male) brilliant green. *Hab.*, Veragua.
  *L. veraguensis* GOULD. *Veragua Humming Bird.*‡

The first of the above-characterized species has been included in several works on North American birds, on the strength of a specimen that was given to Mr. Audubon by Dr. Bachman, who received it from their "mutual friend, Dr. Strobel," who claimed to have obtained it at Key West, Florida. If the specimen was really obtained at Key West, its occurrence there must be considered as purely accidental, since it is not even found in the West Indies, nor along the Central American coast, but is a South American bird, with the Isthmus of Panama as its normal northern limit.

BLACK-THROATED MANGO HUMMING BIRD. *Lampornis nigricollis* (VIEILL.).

*Trochilus nigricollis* VIEILL., Nouv. Dict. Hist. Nat., VII, 1817, 349.
  *Lampornis nigricollis* VON BERLEPSCH, J. f. O., 1884, 309.
*Trochilus mango* AUD., Orn. Biog., II, 1834, 480, pl. 184; B. Am., IV, 1842, 186, pl. 251 (not of LINNAEUS).
  *Lampornis mango* GOULD, Mon. Troch., pt. XII, 1856, pl. 12; vol. II, 1861, pl. 74.—B. B. and R., Hist. N. Am. B., II, 1874, 440.

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* *Trochilus prevosti* LESS., Hist. Nat. Col., 1831, 87, pl. 24.—*Lampornis prevosti* GRAY, Gen. B., I., 108.

† *Lampornis hendersoni* CORY, The Auk, IV, July, 1887, 177.

‡ *Lampornis veraguensis* GOULD, Mon. Troch., pt. XV, May, 1858, pl. 9; vol. II, 1861, pl. 76.

The Mango (GOULD).
Mango Humming Bird (AUDUBON).
Black-throated Humming Bird (COUES).
Le Lampornis mango (MULSANT and VERREAUX).

RANGE.—Northern South America, from the Isthmus of Panama to Brazil and eastern Peru; accidental at Key West, Florida?

SP. CHAR.—*Adult male* golden green above, middle tail-feathers darker; rest of tail rich chesnut, glossed with purple, the feathers broadly margined at ends with purplish black; median portion of body beneath opaque black, the lateral portions metallic blue anteriorly, bronze-green posteriorly. *Adult female* with median under parts black, bordered along each side by white; tail-feathers more extensively black terminally, the three outermost often with whitish tips.

*Adult male* (No. 119363, Panama, 1862; J. McLeannan): Above bronze-green, darker and less bronzy on top of head; middle pair of tail-feathers dull greenish black; other rectrices deep purplish chestnut, richly glossed with metallic violet, each feather broadly margined terminally with glossy blue-black, and with the shaft clear chestnut; outer feather with outer web broadly edged with purplish black; remiges dusky, very faintly glossed with purplish. Chin, throat, chest, and middle line of breast and belly opaque velvety black, that of the chin, throat, and chest bordered laterally by a band of metallic blue, gradually passing into green on the sides of the neck; sides and flanks bronze-green; under-tail coverts dark metallic green, the basal portion of the feathers dusky; downy tufts between flanks and rump, pure white. Bill black, feet dusky. Length, skin, 4.10; wing, 2.60; tail, 1.45 (middle feathers, 1.35; exposed culmen, 0.85.

*Adult female* (No. 2702, "South America;" J. Cassin): Top of head dull grayish brown, glossed with bronze-green; rest of upper parts bronze-green, mixed with golden bronze; middle tail feathers dull bottle-green, with dusky tip; next feather with outer web similar, but inner web dull blue-black for terminal half and greenish dusky basally, with a small spot of chesnut about one-third the distance from the tip; next with more than the basal third green on outer web, dusky on inner, the remaining portion blackish terminally and laterally, the central portion occupied by a broadly lanceolate patch of chestnut, about 0.50 of an inch long, the extreme tip of the feather white; next feather similar, but chestnut patch and white terminal spot both more extensive, the latter passing into rusty anteriorly; outer feather chestnut, with base, broad margin to outer web, and still broader terminal margin of inner web (both reaching nearly to the shaft near end of the feather) black, the tip dull whitish and the shaft nearly pure white. Sides of head similar to top, but darker; chin, sides of throat, and malar region, together with breast and belly (except along median line), white; a velvety black stripe extending from upper part of the throat along median line of under surface as far as the lower belly; sides of neck bright bronze-green, the sides of the body (from breast to flanks) similar, but more bronzy; under tail-coverts bronze-green, margined terminally with pale grayish; bill and feet dusky. Length, skin, 4.25; wing, 2.55; tail, 1.50 (middle feathers, 1.40), exposed culmen, 1.00.

*Immature birds* (*both sexes?*): Resemble the adult female, but have the feathers of the upper parts tipped with pale dull buffy, and the white bordering the black median stripe of the under parts sometimes mixed with light brown.*

*Nestlings*: "At a very young age the upper surface is bronzy green; the under surface white, spotted down the sides of the neck and body with chestnut-red, the spots being arranged in a double line from the angle of the lower mandible, and leaving a line of white between them and the eye."

This is a very abundant species in northern South America, but does not occur, so far as known, north of the Isthmus of Panama. It was introduced as a North American bird, however, by Mr. Audubon, on the strength of a specimen given him by Dr. Bachman, which was alleged to have been taken by Dr. Strobel at Key West, Florida. If the specimen in question was really taken at Key West, its occurrence there must of course have been purely accidental.

The circumstances attending the case are thus given by Mr. Audubon:

> It affords me great pleasure to introduce to the lovers of natural history this species of Humming Bird as an inhabitant of the United States. The specimen which is now in my possession was obtained by Dr. Strobel at Key West in East Florida. He informed me that he had succeeded in capturing it from a bush where he had found it seated, apparently wearied after its long flight across the Gulf of Mexico, probably from some of the West India Islands or the coast of South America. Whether this species is numerous in any part of Florida, I have no means of ascertaining. The interior of that territory, as its name indicates, is the land of flowers, and consequently well suited to the peculiar habits of this genus; and as it has seldom been visited by ornithologists it is possible that not only this, but several other species of Humming Birds, may yet be discovered as inhabitants of our southern country.

### Genus **ATTHIS** Reichenbach.

*Atthis* Reich., Aufz. der Colib., 1853, 12. Type, *Ornysmia heloisa* Less. and DeLattr.

Generic characters.—Similar to *Stellula*, but tail-feathers not inclining to spatulate form, the outer two or three broadly tipped with white in both sexes; feathers of gorget in male broader and without white bases.

The only two known species of this genus are very much alike in general appearance, but may be distinguished by the following characters:

Common characters.—Exposed culmen not more than 0.50; outer tail-feathers broadly tipped with white in both sexes. *Adult males* bronzy green or bronzy above, the middle tail-feathers broadly edged with rufous on inner web, the other tail-feathers with basal half rufous, then purplish black, the two or three outermost broadly tipped with white; gorget rich metallic purplish; chest and other median lower parts white, the sides and flanks rufous, tinged or spotted with greenish or bronzy. *Adult females* similar to males, but throat dull white, spotted with dull greenish or bronzy; under tail-coverts pale rufous; four middle tail-feathers without rufous edgings.

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* According to Gould "the young male is similar to the female, but has the white on each side the neck suffused with chestnut."

$a^1$. *Adult male:* Outer primary narrow, abruptly attenuated at tip; gorget brilliantly metallic reddish violet, with decided violet tints in certain lights. Culmen, 0.48–0.50. *Hab.*, Eastern Mexico.
*A. heloisa* (LESS. and DE LATTR.). *Heloise's Humming Bird.* (Page 380.)

$a^2$. *Adult male* with outer primary broad, not attenuated at tip; gorget metallic reddish purple, without violet tints; otherwise much like *A. heloisa*. Culmen, 0.38–0.40. *Hab.*, Highlands of Guatemala. *A. ellioti* RIDGW. *Elliot's Humming Bird.**

*A. heloisa* has been included in works on North American birds published since 1870, on the strength of a specimen erroneously identified as this species, collected by Mr. J. H. Clark, of the United States and Mexican Boundary Survey, at El Paso, Texas.† It is a species of eastern Mexico, where it inhabits the tropical coast district (and perhaps the temperate slopes also), and may be expected to occur within our limits along the lower Rio Grande.

### HELOISE'S HUMMING BIRD. *Atthis heloisa* (LESS. and DE LATTR.).

(Plate XLVI.)

*Ornismya heloisa* LESS. and DE LATTR., Rev. Zool., 1839, 15.
*Selasphorus ? heloisæ* GOULD, Mon. Troch., pt. VIII, 1854, pl. 2; vol. III, 1861, pl. 141.
*Atthis heloisæ* GOULD, Introd. Troch., oct. ed., 1861, 89.—COOP., Orn. Cal., I, 1870, 361.—B. B. & R., Hist. N. Am. B., II, 1874, 465, pl. 47, fig. 6.
Heloisa's Flame-bearer (GOULD).
L'Atthis d'Héloïse (MULSANT and VERREAUX).
Chupamirto de peto violado purpúreo (D'OCA).

RANGE.—Eastern Mexico.

SP. CHAR.—*Adult male*, with gorget rich metallic magenta-purple, with steel-blue reflections, the feathers much elongated posteriorly and laterally; tail feathers all extensively rufous basally, the three outer ones tipped with white and with a subterminal black patch; length about 2.70–2.75; wing, 1.30–1.50; tail, 0.95–1.10; exposed culmen, 0.45–0.50. *Adult female*, similar to the male above, except that the middle pair of tail-feathers are without any rufous, while that on the other rectrices is much more restricted; chin and throat white (tinged with rusty laterally), spotted with bronze; chest and middle line of breast and belly dull white; sides and flanks cinnamon-rufous; under tail-coverts cinnamon-buff; length (skin), 3.25; wing, 1.40; tail, 0.80; exposed culmen, 0.48.

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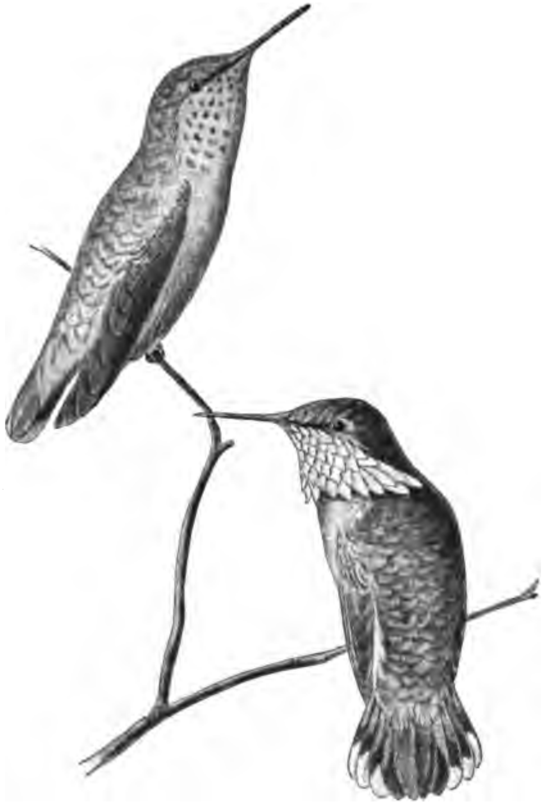
*[Atthis ellioti](#) RIDGW., Proc. U. S. Nat. Mus., I, July 1, 1878, 9.

† See The Auk, Jan., 1891, p. 115.



HELOISA'S HUMMING BIRD (*Atthis heloisa*).
Male. (Cat. No. 24616, U. S. N. M. Xalapa, Mexico. Collected by R. Montes de Oca.)
Female. (Cat. No. 24618, U. S. N. M. Xalapa, Mexico. Collected by R. Montes de Oca.)

*Adult male* (No. 24616, Jalapa, Mexico; Dr. A. L. Heermann): Above metallic greenish bronze, strongly tinged with golden bronze on hindneck, back, scapulars, and rump; remiges dusky, very faintly glossed with purplish; middle pair of tail-feathers bronze-green, the basal portion cinnamon-rufous, this most distinct on edges (broadly) where continued half-way to the tip; next pair of feathers cinnamon-rufous, tipped with a guttate spot of purplish black, this preceded by a broad, V-shaped patch of metallic bronze-green; remaining rectrices broadly tipped with white and crossed by a broad, subterminal patch of purplish black, the basal portion of all light cinnamon-rufous. Ear-coverts grayish brown or olive; gorget, including chin, malar region, and entire throat, brilliant metallic magenta-purple, with steel-blue and even greenish reflections; the more posterior, and especially the postero-lateral, feathers much elongated (the longest extending nearly 1.00 inch from the chin-angle), the individual feathers rather narrow but with rounded tips; chest, breast, belly, and under tail-coverts white; sides and flanks light rusty, glossed in places with golden bronze; bill and feet black; length (skin), 2.75; wing, 1.50; tail, 0.95; exposed culmen, 0.50.

*Adult female* (No. 24618, Jalapa, Mexico; Dr. A. L. Heermann): Above bright metallic bronze-green, tinged with golden bronze, duller on top of head; remiges dusky, with faint purplish reflections; middle pair of tail-feathers metallic green, passing into blackish at tips, but without rufous at base; next pair with a terminal spot of light cinnamon, then purplish black for about 0.22 of an inch, the remaining portion cinnamon-rufous, with a small space of green between this color and the black, on the outer web; next feathers similar, but terminal spot whitish instead of cinnamon, with black more extensive and only a trace of the green space; next, similar, but terminal spot pure white and a little larger; outer feather similar to the second, but white spot a little larger, and basal portion much duller, as well as paler, rusty. Chin and throat white, tinged with pale rusty laterally, spotted with bronzy brown; chest plain white; sides and flanks cinnamon-rufous, the belly whitish; lower tail-coverts cinnamon-buff; bill and feet black; length (skin), 2.85; wing, 1.40; tail, 0.85; the outer feathers 0.10 shorter; exposed culmen, 0.48.

The specimen from El Paso, Texas, referred to in the "Ornithology of California," "History of North American Birds," and subsequent works as being this species, proves to be a young example of *Stellula calliope.* (See The Auk, January, 1891, p. 115.)

### Genus **AGYRTRIA** REICHENBACH.

*Thaumantias* BONAP., Rev. et Mag. Zool. 1854, 255 (*nec* ESCHOLTZ, 1829).
*Thaumatias* GOULD, Introd. Troch. oct. ed. 1861, 151 (*nec* BONAP., 1850).
*Agyrtria* REICH., Troch. Enum. 1855, 7. Type, *Trochilus brevirostris* LESS.
*Leucodora* MULS., Hist. Nat. Ois. Mouch. i, 1873, 309. Type, *Trochilus norrisii* BOURC.

GENERIC CHARACTERS.—In what the characters of this supposed genus really consist, I have not been able to discover, either by a careful examination of specimens or by consulting the various works which recognize it. The various species referred to *Agyrtria* are essentially identical in structure with the species referred to *Amazilia*, and in my opinion should be placed in the same genus with them. Other so-called genera, as *Uranomitra*, *Timolia*, *Eucephala*, *Arinia*, and *Callipharus*, are also involved in the uncertainty. (See p. 362.)

Taking the single species which has been mentioned as a North American bird, together with all the Central American species which have been placed in the same so-called genus, we have four species of *Agyrtria* whose differential characters are as follows:

$a^1$. Throat and breast green.
  $b^1$. Outer tail-feather blackish, with dusky gray tip. *Hab.* Tobago, Trinidad, and Venezuela to Brazil; accidental in Massachusetts?
    *A. tobaci* (GMEL.) Tobago Humming Bird. (Page 382.)
  $b^2$. Outer tail feather bronzy green, with dark purplish bronze subterminal band and gray tip. *Hab.* Honduras. *A. luciæ* (LAWR). Lucy's Humming Bird.[*]
$a^2$. Throat and breast white.
  $b^1$. Belly pure white, flanks green. *Hab.* Mexico to Nicaragua.
    *A. candida* (BOURC. and MULS.). White-breasted Humming Bird.[†]
  $b^2$. Belly and flanks pale rufous. *Hab.* Mexico.
    *A norrisii* (BOURC.). Norris's Humming Bird.[‡]

### TOBAGO HUMMING BIRD. *Agyrtria tobaci* (GMEL.).

*Trochilus tobaci* GMEL., S. N. I., 1788, 498.
  *Agyrtria tobaci* ELLIOT, Class. and Synop. Troch., 1879, 206.
*Thaumatias linnæi* GOULD, Mon. Troch., pt. XII, 1856, pl. 4, vol. v, 1861, pl. 302. —B. B. and R. Hist. N. Am. B., II, 1874, 468.[§]
  *Agyrtria linnæi* COUES, Key, 1872, 186.
*Trochilus maculatus* VIEILL., Ois. Dor., I. 1802, 87, pl. 44.
  *Agyrtria maculata* CAB. and HEINE, Mus. Hein., III, 1860, 33.—MAYN., B. E. Mass., 1870, 128 (Cambridge, Mass.).—ALLEN, Am. Nat., III, Feb., 1870, 645 (do.).
Linnæus's Emerald (GOULD).
Le Thaumatias de Linne (MULSANT and VERREAUX).
Linné Humming Bird (COUES).

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[*] *Thaumatias luciæ*, LAWR. Pr. Ac. Nat. Sci., Phil., 1867, 233. *Agyrtria luciæ*, ELLIOT, Class. and Synop. Troch., 1879, 208.

[†] *Trochilus candidus*, BOURC. and MULS., Ann. Soc. Ag., Lyons, ix, 1846, 326. *Agyrtria candida*, CAB. and HEINE, Mus. Hein., iii, 33.

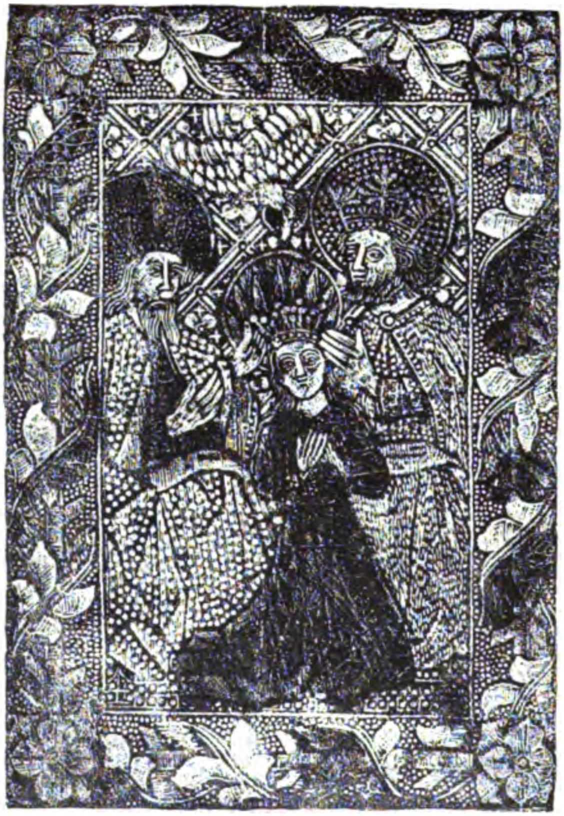
[‡] *Trochilus norrisii*, BOURC., P. Z. S., 1847, 47. *Agyrtria norrisii*, ELLIOT, Class and Synop. Troch., 1879, 204.

[§] Not *Thaumantias linnæi* BONAP., Rev. et Mag. Zool., 1854, 255, based on *Trochilus thaumantias* LINN. (S. N. ed., 12, I, 1766, 190), which is certainly not this species.

RANGE.—Tobago, Trinidad, Venezuela, Guiana, and northern Brazil; accidental in eastern Massachusetts (?)

SP. CHAR.—*Adult* (No. 88468, U. S. National Museum, Surinam; Count von Berlepsch): Above dark bronze-green, including two middle tail-feathers, the latter, however, much duller green than the back; remiges dusky, very faintly glossed with purplish; outer tail-feather dusky, inclining to blue-black subterminally, the tip dusky gray for about .20 of an inch; next feather similar, but with the dusky grayish tip much less distinct, and the outer web slightly glossed with dull bronze-greenish, except for terminal third; next feather with dusky gray tip reduced to a narrow terminal margin, and the outer web dis-distinctly dusky bronze-greenish, except terminally; fourth feather similar, but no trace of grayish at tip. Malar region, chin, throat, and chest, bright metallic emerald-green, more yellowish green laterally, the feathers of the chin and throat dusky grayish at base, with a white bar between the dusky and the green, those of the chest dusky immediately beneath the surface; breast, sides, and flanks bronze-green; sides of belly similar, but feathers margined with pale grayish or grayish white; middle line of belly (narrowly) white; downy femoral tufts pure white; under tail-coverts brownish gray, broadly margined with white. Upper mandible black; lower pale yellowish brown (pinkish in life), becoming blackish at tip; feet dusky. Length (skin), 3.90; wing, 2.15; tail, 1.20 (outer feathers a little shorter); exposed culmen, 0.80.

A specimen of this species is in the collection of Mr. William Brewster, which is said to have been taken in the vicinity of Cambridge, Massachusetts, in August, 1865. If it were really taken there, its occurence must of course be regarded as purely accidental. (See remarks on page 313.)



DOTTED PRINT.
(Coronation of the Virgin.)
(Close of the fifteenth or beginning of the sixteenth century.)
(From print in the National Museum).

# WHITE-LINE ENGRAVING FOR RELIEF-PRINTING IN THE FIFTEENTH AND SIXTEENTH CENTURIES.

## (DOTTED PRINTS, GRAVURES EN MANIÈRE CRIBLÉE, SCHROTBLÄTTER.)

By S. R. Koehler, *Curator of Graphic Arts.*

The U. S. National Museum has lately come into the possession of a few impressions from relief-blocks of the fifteenth or early sixteenth century which bear upon the much-discussed question as to the nature and origin of the so-called "dotted prints" (French: "gravures en manière criblée"; German: "Schrotblätter"). The acquisition of these interesting specimens affords an opportunity for the re-publication in amplified form of an article on this subject, written by me for a European journal.*

It is the aim of this article to show that the prints in question are simply *white-line engravings for relief-printing*, and that, as such, they are identical, in the technical principle involved, with modern wood-engraving, which also is white-line engraving for relief-printing, the whites and the tints intermediate between black and white being produced in both cases by white lines and dots cut into the block, while the black is supplied by those parts of the wood (or metal) left standing in relief and carrying the ink. The conclusion embodied in this statement, which places these primitive and rude performances technically on a level with the delicate and refined work of men like King, Cole, Closson, Juengling, Miller, etc., may seem strange to absurdity to those who are not accustomed to consider processes without regard to the artistic character of the result reached. It is, nevertheless, unavoidable, as the following investigation will demonstrate.

The "dotted prints" form a group quite by themselves among the products of the reproductive or multiplying arts at the close of the fifteenth and the beginning of the sixteenth century. The "Coronation of the Virgin," here reproduced (Pl. XLVII) from one of the specimens in the Museum, is a good, although minor, example of the whole class.* The large white dots observable in it, as in most—although, as we shall presently see, by no means in all—of the prints here to be considered, gave rise to the English name "dotted prints," as well as to the French designation, "manière criblée," the latter in allusion to "le crible," the sieve, a utensil which, in its older forms, is made of a piece of sheet-tin perforated by round holes. The German "Schrotblätter" or "geschrotene Arbeit," from "schroten," (to grind corn coarsely, to cut or saw rudely) expresses another peculiarity of these prints, the rude way, namely, in which the ground in many of them seems to have been gnawed out rather than cut. In drawing, most of the "dotted prints" are quite primitive, and there is noticeable in them a very marked predilection on the part of their designers or engravers for ornamental backgrounds and accessories.

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* See "Chronik für vervielfältigende Kunst," Vienna, 1889, vol. II, No. 9.

Owing to the inartistic character just alluded to, the tendency among the older writers on the subject was to rank these prints among the earliest specimens of the arts of engraving and printing, and to carry their origin back to the beginning of the fifteenth century. At present it is thought, however, that the rudeness of most of the designs is evidence of lack of skill in the artists rather than of antiquity, and that it will be safe to assume about the middle of the fifteenth century as the oldest *probable* date. If this be so, the "manière criblée" was quite short-lived, as there is good reason to believe that it was not practiced much beyond the beginning of the sixteenth century. In quantity the "dotted prints" are also quite limited. According to Dr. Willshire† only about three hundred were known fifteen years ago, and although this number has been added to by new discoveries since then, they are still decidedly rare. Finally, it may be said that most of these prints are of small or medium size, comparatively few only measuring as much as about 10 by 14 inches.

It would seem from all this as if the prints in question had been given an importance in the history of the multiplying arts and in the appreciation of collectors not warranted either by their artistic character or their bulk. It must be conceded, however, that they are very interesting, and no one who has met with them can have failed of having been struck by their unique appearance as compared with all other contemporaneous attempts at producing pictures multipliable in the press. Their most obvious characteristic is that the design is mainly brought out by white dots and lines, or sometimes by white dots only, or by white lines only, on a black ground, which is precisely the reverse of the ordinary wood-cuts of the time, these being to all intents and purposes reproductions of drawings in black lines on a white ground, or, in other words, black-line fac-simile work. The strange appearance of the "dotted prints" is furthermore increased by the admixture of ordinary work in black lines on a white ground with the work in white lines and dots on a black ground, so that it would seem as if two opposing principles, harshly contrasting with one another, had been utilized in their execution. The result was that most investigators were sorely puzzled as to the nature of these queer productions. All sorts of speculations were indulged in as to the material—whether wood or metal—and the *modus operandi* employed, one of the suggestions offered being that they were the outcome of a combination of intaglio-engraving and relief-engraving, and it was naturally enough asked, what motive could possibly have prevailed upon their originators to adopt such an "irrational" method of proceeding?

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* Measurements, through the center, 73 by 106 millimeters. Partly colored red, yellow, and light green; the red, thick and glossy, as if it had been gummed. The obscurations in the reproduction are due to the coloring. Mr. W. L. Schreiber, of Franzensberg, Germany, to whom I sent a photograph of this print, kindly calls my attention to the fact that it is identical with Weigel's No. 333. See Weigel und Zestermann, "Anfänge der Druckerkunst," Leipsic, 1866, vol. II, p. 236.

† "Introduction to the study and collection of ancient prints," 2d ed., London, 1877, vol. II, p. 67.

"Criblé," says Mr. Henri Hymans, the excellent curator of the print department in the Royal Library of Belgium, in his essay entitled "Gravures criblées,"* "is a sort of engraving in which the subject is worked out by a combination of dots and of lines crossing one another, and relieved white against a black ground; but in which, nevertheless, black lines on a white ground are also seen, producing a more curious than happy combination of intaglio-engraving (*gravure en creux*) and relief-engraving (*gravure en relief*)." Again, speaking of a still-existing plate engraved on copper for relief-printing, of which an impression is given in the article in question (see the reproduction, Pl. XLVIII), Mr. Hymans says that it is "executed in intaglio and in relief at one and the same time. * * * The features, the rays which surround the heads of the saints, the folds of the drapery, in a word, everything which marks form, is engraved in relief, as in wood-engraving; † elsewhere, however, intaglio-engraving (*la taille douce*) has been used to a considerable extent, and produces in the impression white lines on a black ground. * * * If we ask for the reasons which may have prevailed upon the artist to use so tedious and difficult a process, and one, moreover, so limited in its means of expression, * * * we can only find them in the necessities forced upon him by a long edition and the desire to prevent the wearing of the plate. * * * Unfortunately the existence of the plates [plate?] * * * can throw light only upon the technique of the curious and irrational art which forms the subject of our article, without allowing us to draw a conclusion which would bring us a step nearer to the discovery of its origin."

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* See "Documents iconographiques et bibliographiques de la bibliothèque royale de Belgique." Brussels, 1887, pp. 14, 17, and 18.

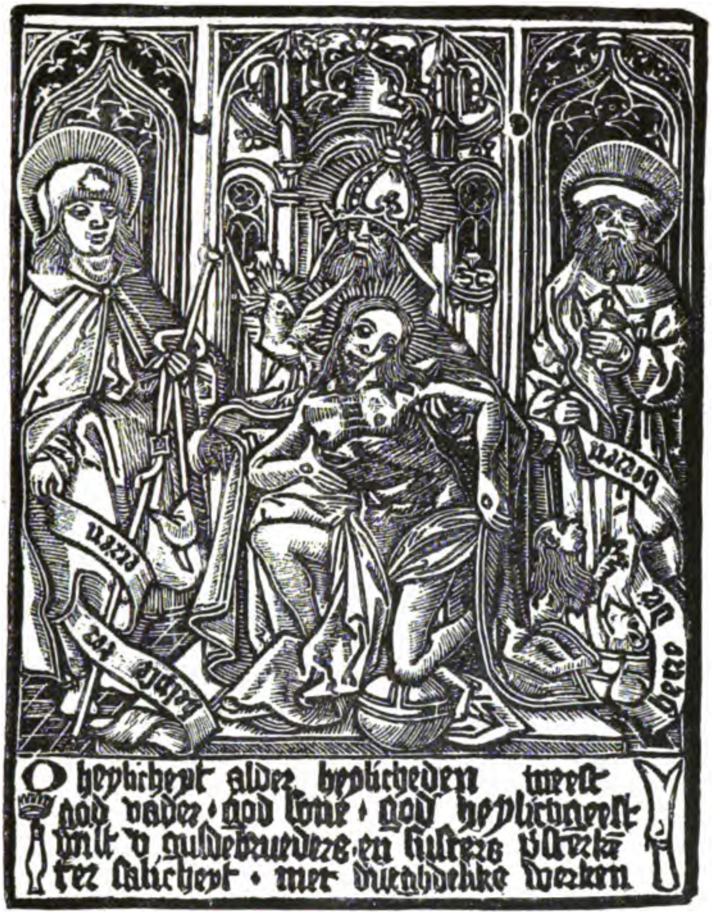
† This is not quite correct, as the rays of the nimbi are decidedly white on a black ground.

Upon these remarks of Mr. Hymans an English writer has based a most astonishing hypothesis, which is calculated to make an already apparently very difficult matter still more difficult.

"The more we look," says Dr. Willshire (vol. II, p. 58, of his otherwise very useful "Introduction," before quoted), "the more inclined are we to believe that the ground [should be, the surface] of the original plate [*i. e.*, of the plate on which the engraving was executed] has remained for the greater part in *relief*, as it were, and has been inked, and that the white forms or the dots and lines have been cut in *intaglio*, kept free of ink, and so appear white off black in the impression. But in other parts it would seem that the ground [should again be, the surface] has been kept clean or uninked, and the cut or intagliated lines and scratches have been inked and appear black off white, as in ordinary copper plate impressions. Where the inked or black *ground* appears to give the forms, the plate or block may be said to have been engraved in relief or *en taille d'épargne;* but where the inked intagliated *lines* or *scratches* indicate them, it must have been engraved *en creux.* This strange mixture of work and effects gives rise, as Mr. Hymans observes, to a combination more singular than agreeable."

The hypothesis involved in the preceding paragraph is so extraordinary that one is inclined to think there must be some misunderstanding. The summing up, however, of his investigations and speculations, given by Dr. Willshire on pp. 65 and 66, leaves no room for doubt. "That a clear and full knowledge," he says, "of the exact mode of execution of the *manière criblée* is yet a *desideratum*, we candidly admit in the face of what we have already stated. Nevertheless we believe we are so far right in maintaining, first, that it was generally practiced on metal plates; secondly, that the engraving was both in relief and intaglio, according to circumstances; thirdly, that the larger 'dots' were punched out of the metal, and the smaller ones indented, but not to complete perforation, or at any rate that all the punctiform technic was in intaglio, and did not receive ink; fourthly, that narrow lined forms or contours, indicated in the impression by black detaching itself from a white ground, were often from relief-engraving on the metal; fifthly, that narrow-lined engraved work and hatchings, indicating texture and shadow rather than forms in the impression, were from work in intaglio; sixthly, that the peculiar effects produced by the admixture of engraving *en creux* and *en taille d'épargne* were added to and varied by the removal of the ink in certain parts before printing."

If the explanation attempted by Dr. Willshire were borne out by the facts, the method of procedure adopted by the engravers of the "dotted prints" might, indeed, justly be called "irrational." It is evident, however, from the quotations given from the dissertation of Mr. Hymans, that the conclusions drawn by the English writer find no basis whatever in the utterances of his Belgian colleague. Mr. Hymans does not even hint at a combination of relief-*printing* with intaglio-*printing* in


O heylicheyt alder heylicheden tweest
god vader · god ſone · god heylichgeest
wilt v guldebruederes en ſuſters vſterkē
ter ſalicheyt · met dueghdelike werken

RUDE WHITE-LINE (TINT) ENGRAVING.

(The Trinity between St. Crispinus and St. Crispinianus.)

(From the impression given by Hymans).

the production of the "manière criblée" prints. Dr. Willshire simply allowed himself to be misled by the somewhat unfortunate expression "a more curious than happy combination of intaglio-engraving with relief-engraving," used by Mr. Hymans. Had he looked at the matter more from the practical-technical than from the theoretical-literary point of view, and had he, moreover, consulted all the historical material at command, the problem would have been less puzzling to him. Looked at in the light thus to be obtained, the last vestige of uncertainty besetting this question, and which caused even Mr. Hymans to characterize the criblés as the productions of a "curious and irrational art," will quickly vanish.

Art has its material as well as its ideal side, and so far as the former is concerned the artist is absolutely dependent upon his means. The two small illustrations which accompany this article (Figs. 48 and 49) look at first sight as if both were taken from "dotted prints" of the fifteenth century. Nevertheless they are separated from one another, as to period, by at least 300 years. Fig. 48 is a fragment of a criblé, "The Stigmatisation of St. Francis," attributed to the last third of the fifteenth century, and published, in a reduction, in Dr. Willshire's "Catalogue of Early Prints," vol. 1, Pl. IV. Fig. 49, is a bit from a wood-engraving by Bewick, which appeared in "Poems by Goldsmith and Parnell," 1795, and is reproduced in Dobson's "Thomas Bewick and his Pupils" (Boston, 1884), p. 79. In the fragments here given, Fig. 48 is reduced about one-third, while Fig. 49 is enlarged about one-half, thus eliminating from the comparison, at least to some degree, the disturbing element of

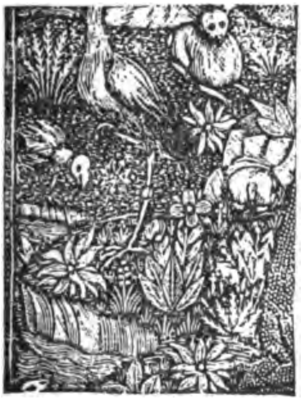


Fig. 48.
FRAGMENT FROM A "DOTTED PRINT" OF THE FIFTEENTH CENTURY.

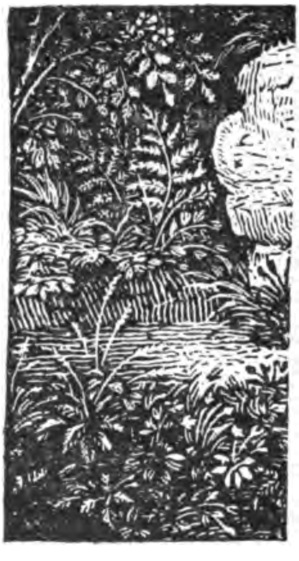
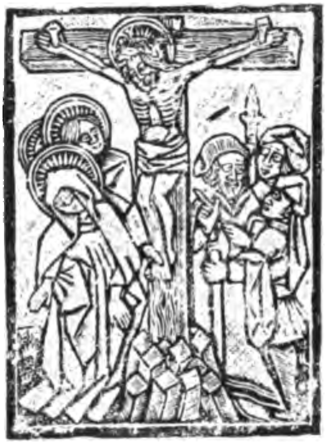


Fig. 49.
FRAGMENT FROM A WOOD-ENGRAVING BY THOMAS BEWICK.

difference in size. It is hardly necessary to point out that both, so far as the means of expression are concerned, rest absolutely upon the same system, although the modern artist displays not only greater skill in the use of these means, but also more refined powers of observation. Their homogeneity is due to the fact that they are drawn with *white lines upon a black ground*, and this again is explained by the further fact that both were *executed with the graver for relief-printing.* That the latter statement must be true will be easily seen when it is considered that the *white line* is the natural product of the graver in its application to relief-engraving, and that consequently the *black line* is used in this kind of engraving only where it can not be avoided; that is to say, in those passages in which forms have to be indicated on a light ground or in high light. This explains also why we find in the "dotted prints" of the fifteenth century the combination of white lines on black and of black lines on white, which has seemed to some investigators to be so curious, and even "irrational." The same combination is found in the wood-engravings of the nineteenth century. But while, owing to lack of skill, it produces an unpleasant crudeness in the works of the relief-engravers of the middle ages, no such crudeness is apparent in the productions of the wood-engravers of to-day, because they have refined the means of expression to a degree of which their mediæval predecessors had not the remotest idea, without in the least altering the principle involved.

It is literally true, therefore, as stated at the outset, that the so-called "dotted prints" of the fifteenth and sixteenth centuries, although executed in the great majority of cases on metal, are simply premature precursors of modern white-line engraving. The fact that they were premature, and that white-line engraving could not develop at the time, but was doomed to die away again after it had hardly made a crude beginning, finds ready explanation in the conditions of the period in which it arose.

The aim of the reproductive arts in their infancy was simply the rendering of *drawings.* It would have been quite impossible for them to attempt the suggestion of the effects of painting as it is understood to-day, not only because the skill was wanting, but also because such effects were not as yet within the grasp of art. It was reserved for the painters of Venice and of the Netherlands to take this step at a considerably later period. The goldsmith, therefore, who desired to become a reproductive artist, took up his graver as an instrument with which he was familiar, and with it he produced, on the copper plate and aided by intaglio-printing, black lines and dots on a white ground, as in drawing. On the other hand, the first artists who endeavored to produce blocks for relief-printing chose a board and a knife, very likely in imitation of the "form-cutters," or makers of wooden molds and stamps, which was an old trade. The knife they were compelled to adhere to,



WHITE-LINE ENGRAVING.
(The Crucifixion.)
(From print in the U. S. National Museum).

as wood cut across the grain was not yet in vogue, and the graver can not be used on wood cut in the direction of the grain or fiber. It is quite conceivable, however, that the advantages of relief-engraving, the ease and more especially the rapidity of printing, were soon discovered by the goldsmiths who wielded the burin, and if this was once the case, it is not to be wondered at that they should have attempted to reach the same end with the means to which they were accustomed. As the graver, however, in its application to relief-engraving, most readily produces *white lines*, they were naturally, and it may indeed be said inevitably, led to the same result as the engravers who first essayed to use the burin for relief work in the eighteenth century; that is to say, they endeavored to produce their drawings by white lines on a black ground, and used black lines only where they could not do without them, namely, in the high lights. They thus arrived at *white-line engraving on metal*, and this again led them unconsciously to the first rude beginnings of tint-engraving. It may be difficult at first, with the modern idea of tint-engraving present to the mind, to detect tints in the "manière criblée" prints. But a little reflection will show that the white dots produced by punches, even without the white lines with which they are often intermingled, served only to break up the black surface and thus to convert it into *tints*. These conclusions once established, it will be conceded that the terms *dotted prints* and *manière criblée* are wholly unjustifiable and inadequate, since the dot is merely an incident. The main point is the elaboration of the design by white lines and dots on a black ground, and this constitutes essentially white-line engraving, which in its development is *tint-engraving*. This being so, it is not to be wondered at that we find "dotted prints" with not a single dot in them. The engraving here reproduced from the impression given by Mr. Hymans (see Pl. XLVIII) is a good illustration of this fact. It is a rude white-line engraving (tint-engraving), without any dots whatever, which clearly shows that it owes its origin to the graver, as, for instance, in the dots in the dark space under the right arm of Christ. The identity of the principle involved with that of modern wood-engraving is, however, still more clearly brought out by an examination of the "Crucifixion" (Pl. XLIX)* here reproduced from the original in the U. S. National Museum. Not only do certain parts, such as the leg of the man at the right and the pieces of wood by which the cross is held in the ground, show well defined tints, but the garments are throughout worked in *white lines crossing one another*. To show that precisely the same method is employed in modern white-line engraving, an enlargement is here given (Fig. 50), by permission of the Century Company, of part of an engraving by Mr. Cole from Mr. St. Gaudens's "Angel of the Morgan Tomb." The face of the angel is engraved with the same white lines crossing one another which we find in the little fifteenth century "Crucifixion," with this difference only, that while the lines of the mediæval artist are rigid and coarse, those of his modern follower are flexible and delicate. It would be more appropriate, therefore, to call these old productions *mediæval white-line engravings for relief-printing*, rather than "dotted prints" or "gravures en manière criblée" or "Schrotblätter."

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*Measurement, through the center, 42 by 57 millimetres. Colored in parts light red, light yellow, light green, in transparent washes. The green, however, seems to be a body color mixed with white, but laid on very thin. Mr. Schreiber points out that this print is Weigel's No. 356. See Weigel and Zestermann, II, p. 270. It passed into Coppenrath's hands and was sold at auction in his first sale, No. 2082. The defects of the reproduction are again due to the coloring.

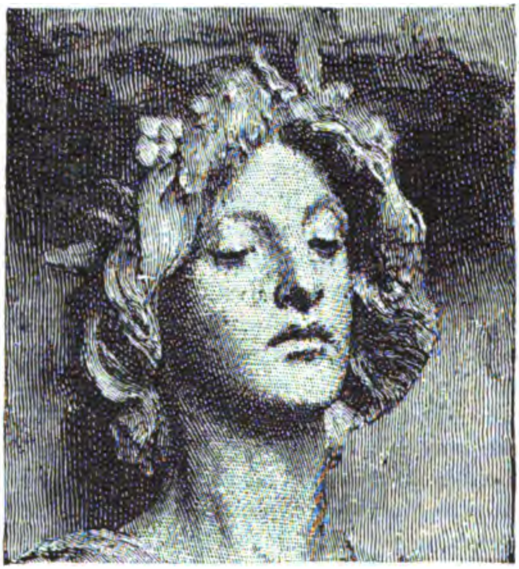

Fig. 50.

ENLARGEMENT OF PART OF A WOOD-ENGRAVING BY T. COLE.

(By permission of The Century Company.)

The use of the white line in the fifteenth and sixteenth centuries is not, however, confined to the class of prints just spoken of. There are extant a few white-line relief-engravings of the same period which have nothing in common with the so-called "dotted prints," and which, judging from the absence of the characteristic love of ornamentation and from the better quality of the draftsmanship, would seem to be, not the work of artisan goldsmiths, but of regular designers and engravers. One of these, ascribed to the close of the fifteenth century, is also here reproduced (Pl. L) from an impression in the U. S. National Museum. That it is not a negative impression, that is to say, an impression printed from an intaglio plate inked on the surface,* is evident from the way in

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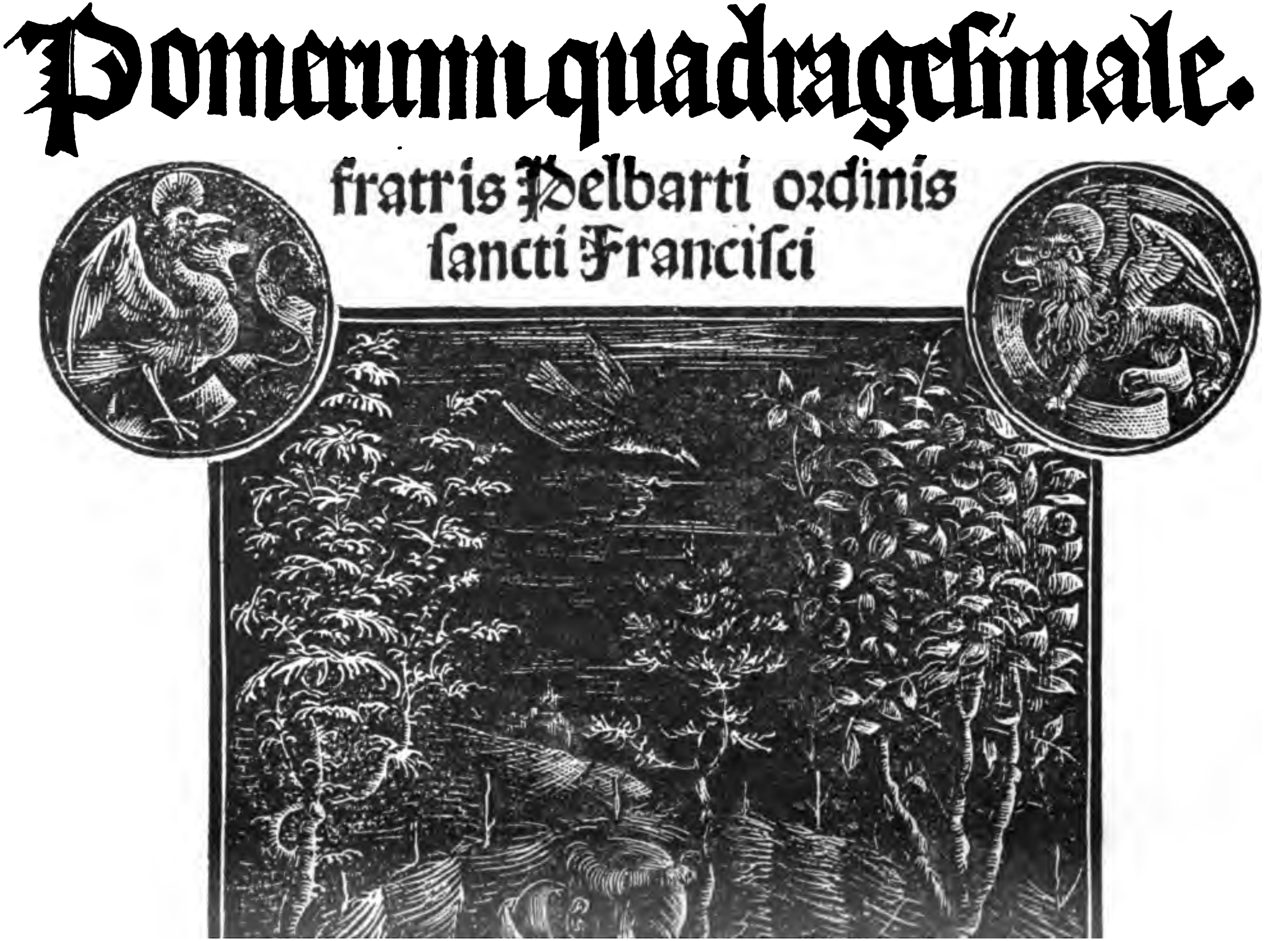
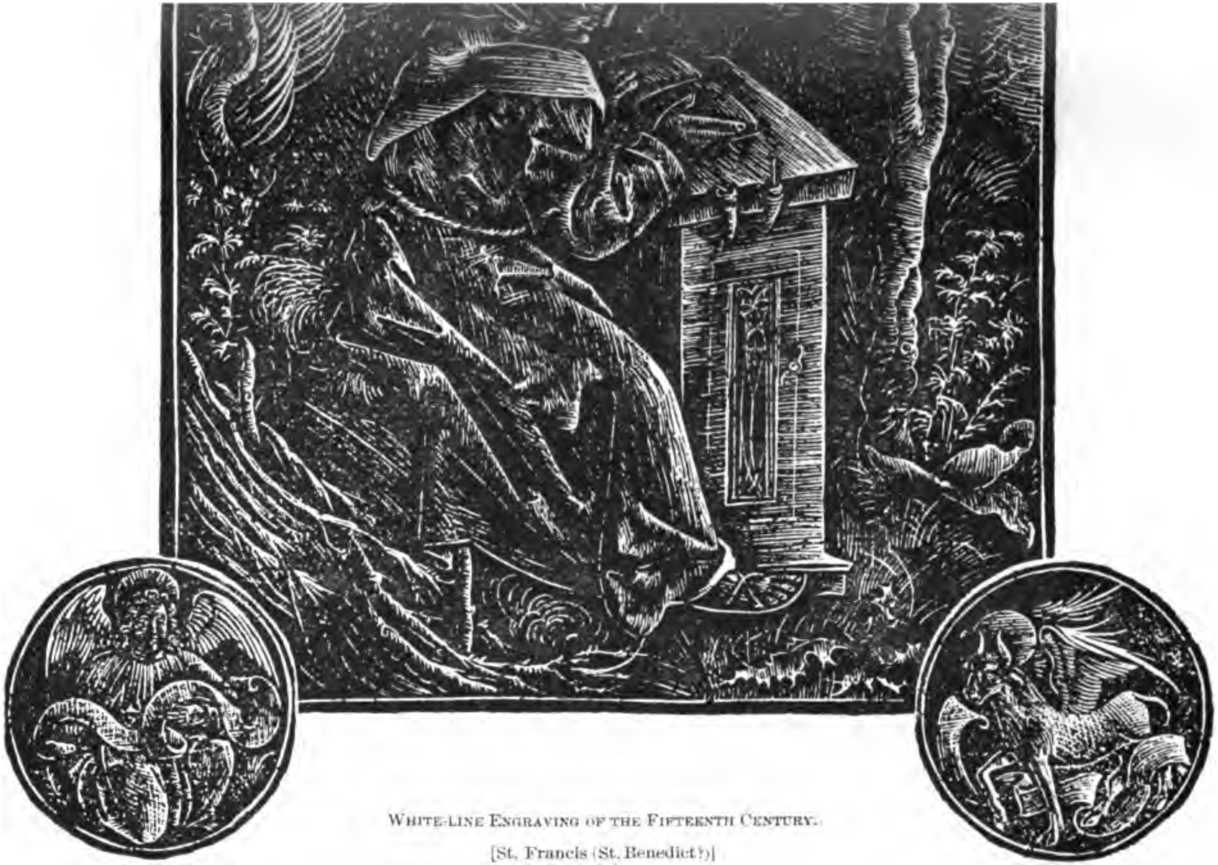
* The subject of negative and positive impressions is illustrated in the U. S. National Museum by prints from both intaglio and relief plates. The specimens in question will be found in the Hall of Graphic Arts, eastern side, alcove 1, in frames 1 and 1*a*.



Pomerium quadrageſimale.

fratris Pelbarti ordinis
ſancti Franciſci

PLATE L.



WHITE-LINE ENGRAVING OF THE FIFTEENTH CENTURY.

[St. Francis (St. Benedict?)]

(From print in the U. S. National Museum.)

p. 392.

which the lights are managed. It is questionable, however, whether this plate was engraved in white lines in obedience to the demands of the graver, or merely with a desire to produce an odd effect.* Of another similar print, "The Satyr's Family," after Urse Graf, dated 1520, a good reproduction of which is easily accessible in Hirth and Muther's "Master Woodcuts of Four Centuries," † it seems almost certain that the motive suggested prompted it. The angularity of some of the curves in it would, indeed, suggest that it was executed with the knife on wood.

It has been pointed out already that the use of the white line, with all the consequences it involves, could not lead to any lasting result at the period under consideration. The possibilities contained in it could not be recognized by the artists of the time, and for the fac-simile reproduction of drawings, intaglio-engraving on metal and relief-cutting on wood were far better fitted. White-line relief-engraving therefore remained a premature shoot, destined to an early decay, since its time had not yet come. But black-line relief-cutting also could not maintain its ground, so soon as it was asked to grapple with painting in the modern sense of the word. For this purpose the plank and the knife were insufficient, and hence the woodcut had to succumb in the competition with intaglio-engraving on metal. It was only towards the end of the eighteenth century, when the graver—this time, however, on wood cut across the grain—again came into use, that relief-work once more found itself in a position to enter the lists; for the new means at its command enabled it to develop *tint engraving*, which made it possible to produce blocks printable on the type-press and yet producing effects suggestive of painting. Modern wood-engraving is no longer content with *drawing;* it *paints*, or at least endeavors to suggest the effects of painting, and therein lies its true importance.

To sum up, it may be regarded as proven that the so called "dotted prints" are white-line engravings intended for relief-printing, that they were executed with the graver, and, in some cases, with punches, on metal (which does not exclude the possibility that similar work may have been done on wood with the knife now and then, in the spirit of imitation), and that, arguing from the means used and the love of ornamentation displayed in them, their originators were goldsmiths.

Although the simple explanation here offered dispels the mystery which, in the eyes of most investigators and collectors, has hitherto enveloped the whole of this class of prints, the latter nevertheless retain their interest, historically as well as technically considered. And it may, indeed, be claimed that the recognition of the true state of the case has given them an added interest which did not attach to them before. This interest flows from the perception of the close connection existing between these crude productions of past centuries and the highly developed technique of our own day, a connection which up to the present has escaped the notice of all observers.

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* This engraving, evidently intended for a title page, occurs in a number of different states as to lettering. An impression in the Royal Library of Belgium, of which Mr. Hymans gives a reproduction, is without lettering. Passavant, "Peintre-Graveur," I, p. 101, describes a second, which would seem to be lettered "Pomerium de tempore, fratris Pelbarti ordinis Sancti Francisci." According to Willshire, "Catalogue of Early Prints," I, p. 320 a third impression, in the British Museum, has the legend "Pomerium de sanctis, fratris Pelbarti ordinis sancti Francisci." Still another impression, in the collection of Mr. Henry F. Sewall, of New York, corresponds with the one here reproduced.

† "Meister-Holzschnitte aus vier Jahrhunderten," Munich and Leipsic, 1890, pl. 108.

# THE METHODS OF FIRE-MAKING.

By WALTER HOUGH,
(*Department of Ethnology, U. S. National Museum.*)

The study of any art includes a knowledge of the materials, the apparatus, the processes, and the finished products. In a former paper* the apparatus of fire-making having been discussed, attention will here be given to the handling of the apparatus, the mechanical principles, the physics, and the chemistry of fire-making.

All mechanical methods of generating fire take advantage of the law that motion, apparently destroyed by friction, is converted into heat. These methods can be grouped under three classess, viz: (1) Wood friction; (2) percussion of minerals; and (3) compression of air.

Three other methods exhaust the entire range of usages in fire-making, and they are with one exception, perhaps, recent. These may be arranged in the following classes: (4) chemical; (5) optical; (6) electrical; but these are also the exhibition of friction in its higher manifestations.

## I.—FRICTION ON WOOD.

There are three well-defined variations in the method of making fire artificially by friction on wood, viz: (1) By twirling or reciprocating motion; (2) by sawing; (3) by plowing.

### 1. FIRE-MAKING BY TWIRLING.

Three kinds of apparatus are used in producing fire by the reciprocating motion, viz: (*a*) Simple two-part hand drill; (*b*) bow and cord four-part drills; and (*c*) the pump-drill.

(*a*) *Simple two-part hand drill.*—This apparatus consists of two parts, a vertical and a horizontal element called the spindle, and lower socket pieces; the latter may be called the hearth, which all the machines under this class agree in possessing. The twirled hand-drill is the simplest form of fire-making tool, and is, without doubt, primitive.

The Eskimo of Labrador, Point Barrow, and other localities, also bore holes with this form of drill. The Haida Indian carpenters, of

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* Smithsonian Report 1888, II, pp. 531-587.

Vancouver Island, employ it. The Indians of the Rio Negro, Amazon, and Oronoco Rivers in South America pierce the hardest stones with a twirling stick and sand. It is found also in Japan and Madagascar, giving it a range coextensive with the simple fire-drill.

Fig. 51 shows the working of this drill in making fire.

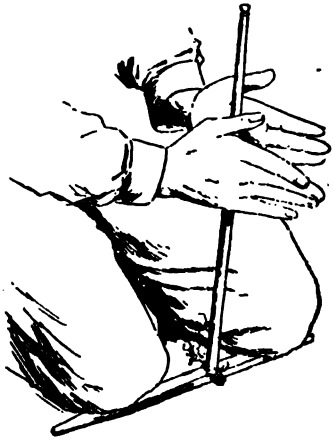

Fig. 51.

MAKING FIRE WITH SIMPLE, TWO-STICK APPARATUS OF THE HUPAS.

(Cat. No. 77193, U. S. N. M. Hupa Indians, California. Collected by Lieut. P. H. Ray, U. S. A.)

A shallow depression is first made near the edge of the hearth in order to give the spindle "bite." From this depression a slot is cut down the side of the hearth as a duct for the wood débris which has been ground off. The operator then takes the spindle by its upper end between the palms of his hands and inserts the lower end in the shallow depression. In twirling, a strong downward pressure is given to the spindle. The hands, which necessarily move down through the combined pressure and the back and forward motion, must be returned quickly to the top of the spindle without allowing the air to get under the lower end of the latter. After continued friction, evidences of combustion are seen in the ground off wood meal. In shaping the lower end of the spindle, it is absolutely necessary that its point should be in contact with the bottom of the shallow depression, otherwise it will "bind" against the edges of the depression and defeat the object.

The usual statement that a spark is ground out, igniting the dust, shows an error of observation. The heap of dust collected in the slot, which is an essential feature, smoulders until enough heat has been evolved to produce ignition by spontaneous combustion.

Flame is never directly secured by this apparatus; the coal must be placed in contact with tinder, or other ignitible substance and fanned into a blaze with great caution. Usually much smoke is generated in the operation.

Great dexterity and quickness are often shown by the natives in starting fire from the glowing coal. This part of the process requires as much care and skill as the securing of the spark. The selection and preparation of tinder must be carefully made and everything must be ready beforehand as in a chemical experiment.

(*b*) *Cord and bow four-part drills.*—Several improvements of the simple drill have been made by savage inventors. These improvements are shown in the cord drill, the bow, or mouth-drill, and the pump-drill. The first is used by the Eskimo, by some tribes of North American Indians, and by Dyak tribes. It adds to the spindle of the simple drill an upper bearing, called a hand-rest, and it revolves the spindle by a cord with handles alternately pulled (Fig. 52). Two men are required to work this drill.

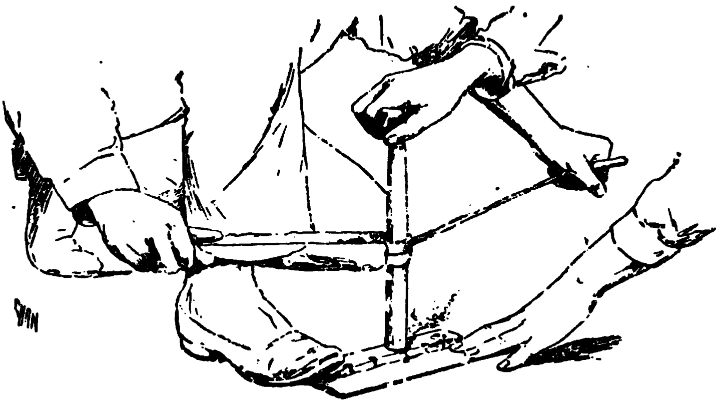

Fig. 52.

USING THE ESKIMO CORD DRILL.

(Cat. No. 36325, U. S. N. M. Chalimute, Alaska. Collected by E. W. Nelson.)

An improvement on the four-part apparatus, just described, rendering it easy for one man to make a fire unaided, belongs exclusively to the Eskimo. The upper bearing, held in the hand in the case of the cord drill, is shaped for holding between the teeth (Fig. 53). The cord is strung on a bow, so that in working this apparatus one hand of the operator is free to apply the tinder or hold the lower piece.

While the cord drill is a vertical adaptation of the Egyptian breast drill, for the purpose of fire-making, the mouth piece is used exclusively by the Eskimo. The four-part fire drill was rarely found among the North American tribes. The Dyaks of Borneo also have the four-part drill.

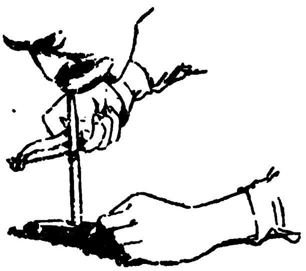

Fig. 53.

USING THE ESKIMO MOUTH DRILL.

(Cat. No. 1327, U. S. N. M. Anderson River, British Columbia. Collected by C. P. Gaudet.)

(*c*) *Pump or weighted drill.*—The problem of a one-handed drill has also been worked out in the invention of the pump-drill (Fig. 54). This tool has a widespread use for piercing substances necessitating light, even pressure, such as perforating wood, horn, shell, turquoise, etc. The Klamath, Pueblo, and other Indian tribes manufacture shell-beads with the pump-drill at present, and it is probable that its use was prevalent in North America in former times. Its connection with the weaver's spindle is marked. In only two localities in the world, as far as is known, has it been adapted to fire-making, viz, among the Chukchis of Siberia, and the Iroquois Indians of New York and Canada.

This pump-drill is said to have been used in making new fire in the white-dog feast of 1888 by the Onondagua Iroquois of Canada. Elm wood is employed. Sometimes a sapling with a straight tap root was selected and dressed down, leaving the large portion at the junction of the root and stem for a fly-wheel.

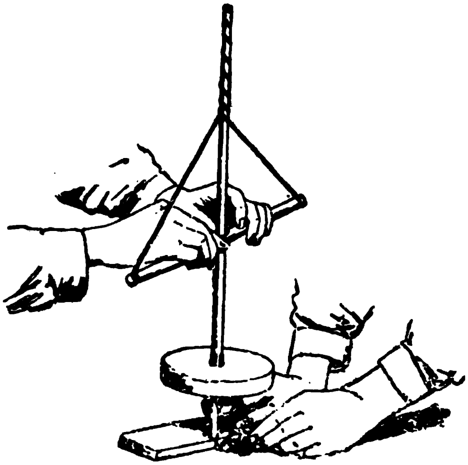

Fig. 54.

IROQUOIS PUMP DRILL FOR MAKING FIRE.

(Cat. No. 150403, U. S. N. M. Onondagua Indians, Canada. Collected by J. N. B. Hewitt.)

Although one person can manipulate this apparatus, others usually assist.

*Essential points in wooden fire-making apparatus.*—There are several points about the lower member of the wooden fire drill that are worthy of consideration. It will be observed in Fig. 54 that the spindle is cutting on one edge of the hearth and the dust has run out through a slot down the side into a little heap.

This canal collects the particles worn off by the spindle and also keeps the air away for a short time. This feature, or something analogous, is found, one may say, in every fire-making device that depends on the friction of wood. The dust must be in such mass and confined in one place, so that the heat may be fostered until it ignites the powder.

In Eskimo apparatus fire is usually made in the middle of a block of wood (1) in cavities along a groove that collects the wood meal; (2) in holes that overlap by connecting holes; or (3) in cavities that have canals leading to a step. These devices are to prevent the dust falling off into the snow.

It appears that some hearths do not possess this feature. The Torres Straits Islanders and the natives of Queensland do not make the slot in the drill-hole.* The Aino drill-hearth, the fire-making set from East Greenland, and one set from Alaska figured in the Smithsonian Report (1888, pt. II, pp. 551, 558, and plate LXXVIII, respectively) show no grooves or canals. The Ainos require 2 to 2½ hours to make fire on their apparatus, and the spark at last is caught by sucking a current of air through the porous spindle. This points markedly the difficulty of making fire without the groove. The drawing of the Eastern Greenland outfit is rather obscure in the plate from which the illustration was taken. The artist, as is often the case in ethnological drawings, probably omitted some details. If the Eskimo, according to

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* Prof. A. C. Haddon. Jour. Anthrop. Inst., Great Britain and Ireland, XIX, May 4, 1890, p. 451.

Holm, made fire in less than half a minute on this apparatus, it must have been with the aid of grooves. In the Alaskan drill spoken of, the holes in the hearth had been worn too deeply for drilling easily, and the margins had all been cut down level before the collector procured the specimen. In the original piece the holes in all probability connected.

Often holes are bored on small rods of wood, allowing the spindle to cut over one edge, forming in a few rotations a notch by which the dust is collected. In all the specimens and drawings of fire-making apparatus examined for the preparation of the paper cited* the Aino drill is the only one with unslotted or ungrooved center holes.

This statement in regard to the essential value of the slot is not advanced to disprove that fire can be made without the use of that feature.

Fire can so be made, but it is a difficult process and must be accomplished by mechanical means, such as are found in the Eskimo drill. The wood must be suitable, and the grinding end of the spindle must have the outline of a flattened arch. Great care is required to avoid dispersing the ring of dust that rolls out under the edge of the spindle. The author believes that the slot is essential to simple hand-drills.

### 2. FIRE-MAKING BY SAWING.

The second method in wood friction is that of sawing, practiced by the Burmese, Malays, some Australian tribes, and pretty generally throughout the East Indies. It consists of a rubber and horizontal piece, both parts of bamboo usually, but sometimes hewn out of a branch of a tree. A notch is cut across the convex side of the lower piece, almost penetrating it. A rubber is prepared having a sharp or knife edge. This rubber is drawn across the lower piece in the groove until the latter is pierced and the heated particles fall through. (Fig. 55.)

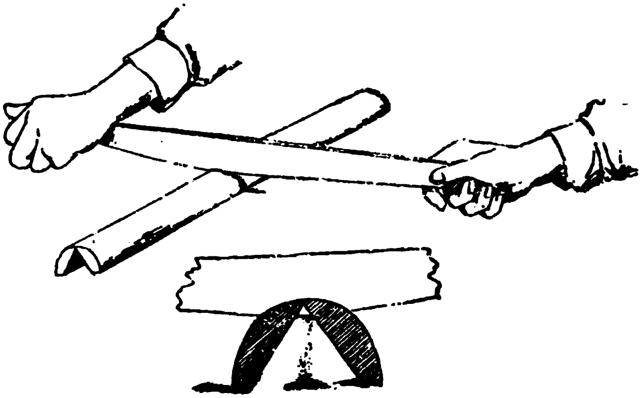

Fig. 55.

FIRE-MAKING BY SAWING, AFTER THE BURMESE AND MALAY METHOD.

(From photograph in the National Museum.)

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* Smithsonian Report, 1888, II, Fire-making Apparatus in the National Museum, pp. 531-587.

In most cases the heated particles are not allowed to fall the whole distance to the ground beneath, which would cool them rapidly, but they drop upon tinder held up to the orifice by slivers of bamboo started from the under side of the lower piece. In some localities the process is reversed and the convex piece holding tinder is sawed upon the knife placed upright. Bamboo is excellent friction material; the siliceous coating is favorable for the development of great heat, while the soft medullary substance on the interior is very inflammable.

Dr. R. M. Luther contributes the following description of the Burmese method of making and using the fire-saw: "A Burmese found a branch of the oil tree (*Dipterocarpus*), hewed in it a V-shaped cavity with his *dah*, cut a knife of iron-wood, sawed with it across the branch, and in less than 3 minutes had a coal of fire underneath. This was taken in some dry leaves, wrapped in a bunch of grass, and whirled around the head, giving a flame in a 'jiffy.'"

The distribution of this method is of great interest. It ranges from Siam across the East Indies into Australia—in many localities, however, in conjunction with other methods of fire-kindling.

### 3. FIRE-MAKING BY PLOWING.

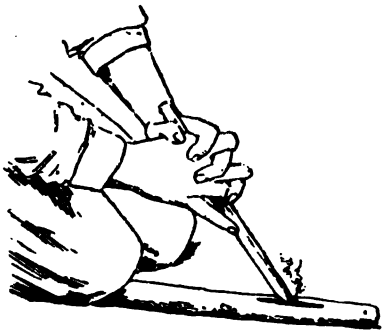

Fig. 56.

FIRE-MAKING BY PLOWING. (DRAWN FROM SPECIMEN IN THE NATIONAL MUSEUM.)

(Cat. No. 130675, U. S. N. M Samoa. Deposited by Harold M. Sewell.)

The mechanics of the third method of fire-making on wood remains to be considered. A short cylindrical stick and a larger billet of wood are required. The smaller stick is clasped between the hands at an angle of about 45 degrees and projected toward and from the body, forming a groove on the lower piece (Fig. 56). The slant at which the plowing stick is held is the angle of greatest friction consistent with command of the rubbing portion of the apparatus. The action of the rubber wears off particles of wood and pushes them along into a heap at the end of the groove, and by acceleration of the motion the dust is brought up to ignition point. The soft hibiscus wood, *H. tiliaceus*, with a rubber of harder wood is usually employed in the Polynesian islands, although this feature is immaterial. This method, as far as known by the author, is exclusively Polynesian, and, strangely, the only one practiced, since most peoples possess more than one fire-making device. Representatives of all stocks in the Oceanic area also practice the plowing method, which was, perhaps, originally Polynesian. This apparatus has advantage of simplicity of parts, but it is rather difficult to work. Flame is said to be sometimes procured by the first operation, without the use of tinder.

### II.—PERCUSSION OF MINERALS.

(*a*) *The flint and steel briquet, or strike a-light.*—The employment of the strike-a-light is familiar still, although long since antiquated. There are few children that have not knocked stones together to see the evanescent glimmer produced. It has been thought that the concussion of two pieces of flint will cause a spark capable of igniting tinder. This is proven to be a mistake, and it is found that an effective spark is due to the presence of iron in some form in the minerals struck together.

The nature of the spark evolved from flint and iron is thought to be chemical; that is, a particle of metallic iron is scraped off by the silica, and, receiving the energy of the blow into its small mass, is heated to incandescence, burning with the oxygen of the air to an oxide. Whether silica enters into the composition of the spark is not known. Silica is a non-conductor and does not abstract heat at the time of the blow.

Upon the introduction of iron, probably, that element replaced the iron pyrites ($FeS_2$) that had been used in early times.

(*b*) *Flint and pyrites.*—The blow of the flint on the pyrites converts enough energy into heat to fuse the latter, setting free sulphurous fumes with a small amount of sulphureted hydrogen. These pellets are not incandescent, but glow at a dull red heat, about 450 degrees, and ignite only "quick" tinder.

The pyrites method at present is limited to a few tribes among the Eskimos and Aleuts and the Fuegians. Some Algonkian tribes bordering upon the Eskimo may have adopted the method from the latter people. The prehistoric use of pyrites for fire-making in several European localities seems to be proven, as far as the finding of bruised nodules and flint-scrapers indicate the purpose for which they may have been intended. Perhaps the limited use of the pyrites *briquet* at the present means that it is a survival from ancient times on the verge of extinction.

### III.—COMPRESSION OF AIR.

*The fire syringe.*—This instrument is, strangely enough, found both in the hands of the physicist and of the various tribes of Dyaks and Burmese. From lack of definite proof to the contrary, it might be classed as a native method of fire-making. Among some tribes the apparatus has a primitive appearance; in others its construction depends on complex manipulation in metallurgy. It varies thus from a cylinder of buffalo horn with a hole bored into it for the piston, to a tube of brass lined with lead, or an ornamented cylinder of cast lead (Fig. 57).

The principle on which the fire-syringe operates is the compression of air which gives up heat under reduction of volume. When this is done under proper conditions, in a non-conductor, the heat is communicated to tinder setting it on fire. This is accomplished by the Dyak thus: "A small piece of tinder is placed in the hollowed end of the piston which is inserted in the mouth of the cylinder. Holding the cylinder in the left hand the knob of the piston is smartly struck with the open hand with sufficient force to drive the piston home. The piston is instantly and quickly withdrawn and the tinder is seen to be alight. Gently breathing on the spark it spreads, fresh tinder is applied, which catches fire immediately; more blowing increases the fire, and first scraped wood and then small sticks catch alight and a fire is produced.

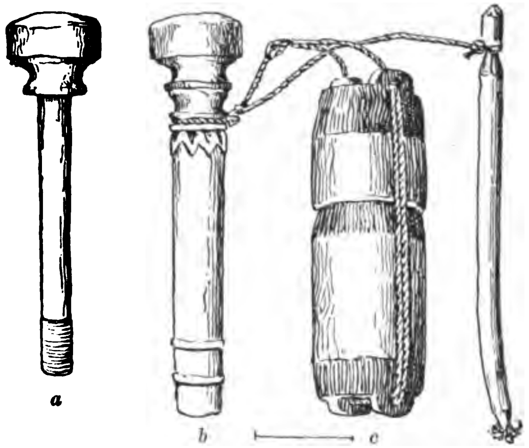

Fig. 57.

DYAK FIRE SYRINGE, OR BESIAPI.

One-half natural size.

*a*, PISTON; *b*, CYLINDER; *c*, TINDER-BOX; *d*, CLEANING STICK.

(From plate in Jour. Anthrop. Inst., Great Britain, xix, 1890.)

It looks very easy but I never succeeded * * * ."[*]

The probabilities are very much against the fire-syringe being an invention of even barbarous peoples of the rank of the Dyaks and Burmese.

## IV.—CHEMICAL METHODS.

The modern lucifer-match is superior to all other devices for producing fire, since it combines in one instrument the arrangements for the creation of the spark, for catching it on tinder, and for starting a blaze; steps requiring separate operations in the primitive machines.

The nearest prototype, of closest resemblance to the friction-match, was the splint of inflammable wood tipped with sulphur which accompanied the tinder-box; prior to this brimstone-match were all the obsolete, or well-nigh obsolete, tinder and slow matches.

The invention of the flint and pyrites and flint and steel strike-a-light necessitated some device to convert the spark into a flame. The Eskimo applies a wick soaked in oil and blows it alight; the Chinese slow match, *maidzu*, as Mr. W. Woodville Rockhill has noticed, only blazes at a quick, dextrous puff of breath. There are many easily ignitible sub-excellent for tinder, however, reach such a condition of oxidization and decomposition that they will not feed a flame, and hence matches are required to complete the operation. The brimstone-match is found in Japan as a broad, thin shaving tipped with sulphur (Fig. 58), and in Mexico it is a cotton wick dipped in sulphur (Fig. 59). In other countries different forms were manufactured.

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[*] S. B. J. Skertchly, Jour. Anthrop. Inst., Great Britain, xix, 1890, p. 448.

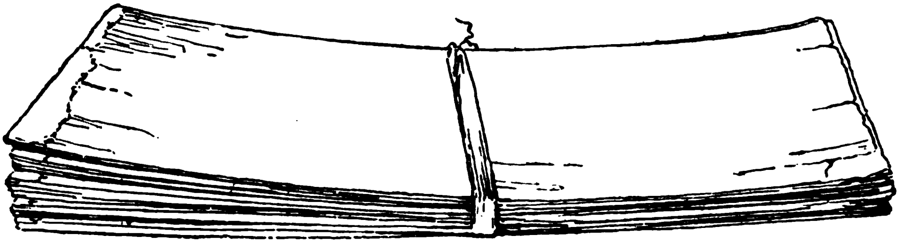

Fig. 58.

BUNDLE OF SHAVING-MATCHES.

(Cat. No. 128136, U. S. N. M. Japan. Japanese Department of Education, Tokio.)

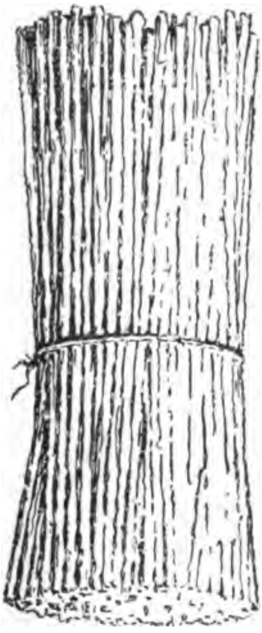

Fig. 59.

SULPHUR-WICKS.

(Cat. No. 76494, U. S. N. M. Oaxaca, Mexico. Collected by L. H. Aymé.)

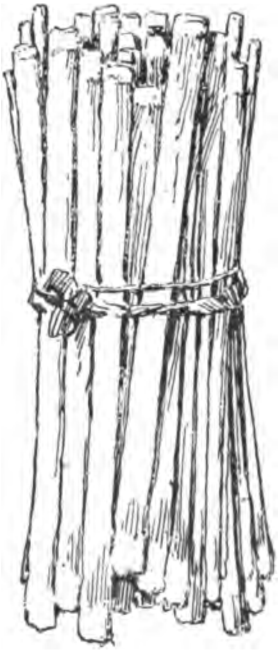

Fig. 60.

SULPHUR "SPUNKS." (Original Bundle.)

(Cat. No. 130309, U. S. N. M. Philadelphia Pennsylvania, 1830. Presented by George G. Fryer.)

The "spunk" (Fig. 60), the common name of the splints tipped with sulphur, was in general use in this country prior to 1825, and lingered in out-of-the-way places long after the introduction of matches. In parts of France it is still in use with the *briquet*, being much more economical to people of simple habits than matches (Fig. 61). The *briquet* has not been altogether superseded by matches. Hunting parties and exploring parties to distant countries carry, besides matches, strike-a-lights for use in case matches are exhausted or meet with some of the many accidents to which they are liable. Patents are still sought, from time to time, for pipe-lighting contrivances, involving the use of silex and steel struck together by some more or less simple mechanical device.

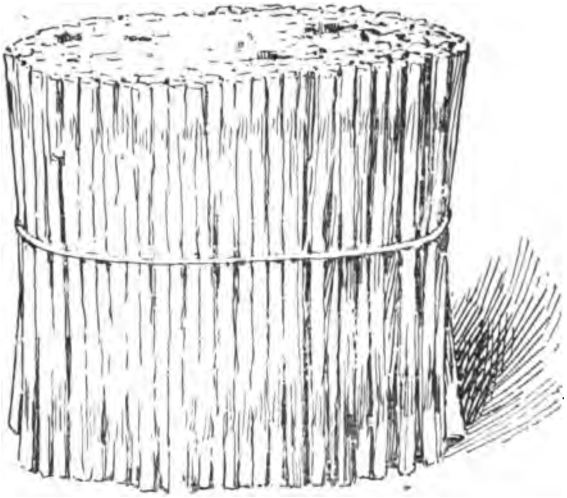

Fig. 61.

Sulphur "Spunks."

(Cat. No. 151438, U. S. N. M. France. Collected by Edward Lovett.)

A variation of the "spunk" match was curled shavings tipped with sulphur (Fig. 62).

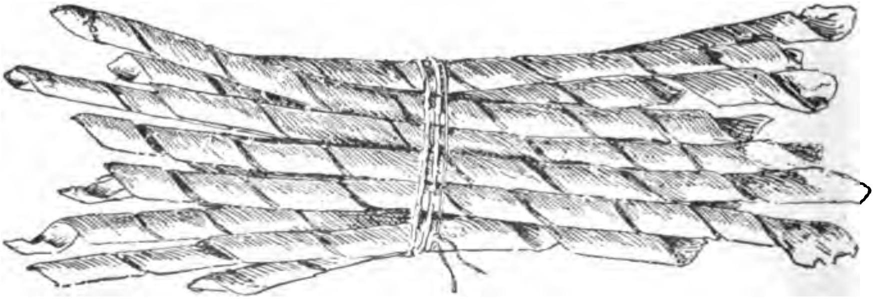

Fig. 62.

Shaving matches. (Original Bundle.)

(Cat. No. 130308. U. S. N. M. Philadelphia, Pennsylvania. Gift of George G. Fryer.)

It is not strange that there was a prejudice against matches at first, because they were poorly made, hung fire, easily absorbed moisture, emitted noxious odors, and were costly. The worst ones were, however, more expeditious than the tinder-box, and the improvements soon made the invention all that could be desired in point of effectiveness. It is, however, worthy of inquiry whether the alarming deterioration of the teeth of the present generation may not be due to phosphorous matches more than to soft food.

Attempts to supersede the clumsy *briquets* produced the tinder pistol, the tinder wheel, and, later, the first chemical match. Dussauce says: "When for the first time a match could be inflamed by dipping it into a bottle full of phosphorous mastic mixed with oxide of phosphorus, the results were fine, but were far from those now obtained. This primitive invention is due to Cagniard de la Tour, and is the foundation of the actual industry of matches inflammable by friction."*

This invention is interesting as marking the first employment of phosphorus in the problem of easy fire-producing. The next invention was called the "Instantaneous light-box," or "Eupyrion," also called "dip-splint," said to have been invented in Vienna in 1809. The only United States patent of this device was in 1814, called "match-light box." It consisted of a tin box, or wooden receptacle, containing a glass bottle filled with asbestos soaked with sulphuric acid, and wood splints tipped first with sulphur and then dipped into a paste made of chlorate of potash 6 parts, powdered sugar 2 parts, and gum Arabic 1 part, the mass mixed with water and colored with some material. The splints were lighted by dipping them into the acid. Victor Hugo describes the outfit under the name of "Fumade's fire-producer," in Les Miserables, where Gavaroche, after several trials, succeeds in eliciting a "sputtering light" in his lodging in the interior of the Elephant, a statue in Paris. Hugo's plot was laid in 1832, but the invention was made public in 1825 or 1826. Owing to great cost in the first instance and to the subsequent loss of value by the decline of strength in the acid, as well as to the hygroscopic nature of the composition on the splints, it had a limited popularity.†

Another fire-producer on this order was the "Prometheans," tubes of glass filled with sulphuric acid surrounded with an inflammable mixture made chiefly of alum and sugar. On being broken they gave an instantaneous light. Another promethean was composed of equal parts of chlorate of potash and sugar mixed with a solution of gum. The sulphuric acid was ingeniously contained in a small glass bead, imbedded in the paste and rolled up in gummed paper. After the bead was crushed with a pair of pliers the acid came in contact with the chlorate and flame resulted.‡

Still another invention of this period was the German "Döbereiner," named for the inventor, a chemical apparatus also known as the hydrogen lamp. A light was obtained by allowing a jet of hydrogen gas to impinge against spongy platinum, which becomes incandescent through some obscure and little understood action, in which the power of platinum to cause the combination of gases plays an important part. The döbereiner consists of a glass jar filled with dilute sulphuric acid, having a flat trap cover, from the center of which hangs down a glass bell, in which are suspended beads of zinc strung on iron wire. On the top of the cover is a jet and stop-cock opening out of the bell, and in front of it is a small chamber containing a bit of spongy platinum. The acid acts on the zinc, producing hydrogen gas as soon as the cock is opened. When the cock is closed, the action ceases, as the acid is forced out of the bell by gas pressure, and the zinc is not acted upon. The jet of gas plays on the platinum, quickly rendering it incandescent and easily setting fire to a splint. (Compare Volta's electric hydrogen lamp.) The döbereiner was rather extensively used in Germany and in other countries. It is still found in laboratories and can be purchased from instrument-makers.

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* H. Dussauce: Fabrication of Matches. Phila., 1864, p. 73.

† See also "Little Dorritt," by Dickens, II, p. 271.

‡ Brande's Encyclopædia, p. 997.

The first United States patent for friction-matches was issued in 1836. It was a chlorate match.

The splints were made by sawing or splitting blocks of wood into slivers slightly attached at the base and dipping the whole bunch. These were known as slab or block-matches (Fig. 63), and, although the first patent, they are in favor in parts of the country to the present day, notably in Maine. Their chief advantages are that they are noiseless and will not leave a mark when scratched on a white wall.

John Walker, of Stockton-upon-Tees, is said to have been the inventor of friction-matches in 1829. The eighth edition of the Encyclopedia Britannica does not give the name of the inventor, and states that matches were invented in 1832. Dussauce states that they were of German invention, and perhaps before 1830.*

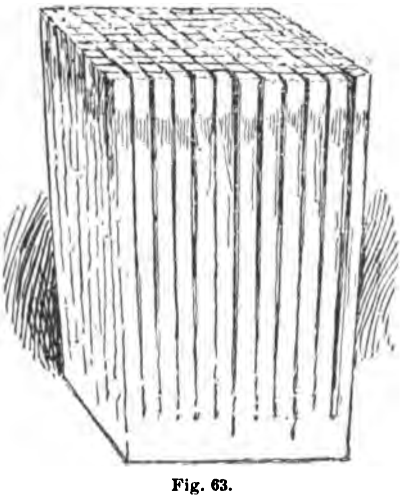

Fig. 63.

Block Matches.

(Cat. No. 131260, U. S. N. M. Collected by Walter Hough.)

The first friction-matches, "lucifers," were made by dipping splints first into melted sulphur and then into a paste of chlorate of potash and sulphide of antimony, mixed with gum water. The paper box contained perhaps one hundred matches and two pieces of fine sandpaper. They were lighted by folding the sandpaper over the end and giving the match a quick pull. The Museum collection contains a specimen of these matches (Cat. No.

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* H. Dussauce. Fabrication of Matches. Philadelphia, 1864; preface, p. iv.

129973, U. S. National Museum), secured from the Essex Institute at Salem, by Prof. F. W. Putnam. The date is about 1833, and they were made in England (Pl. LI.) Quite a common name for them was "loco-focos," evidently of Roman derivation. At first the chlorate of potash lucifers were called "congreves" on account of crackling like a congreve rocket. The composition in many of these matches melted and dropped while burning. These defects, however, were soon remedied with the production of "noiseless lucifers."

The next step was to employ phosphorus, rendering matches easily ignitible with lower temperature and less exertion. A phosphorous match will ignite at 140 degrees, while it is probable that the lucifer required at least 200 degrees. The use of phosphorus for matches dates probably from 1832, being 172 years after the discovery of that element by Brandt, a Hamburg chemist.

Ghan and Scheele have the credit of preparing phosphorous, commercially, from bone. The manufacture of phosphorous matches was attended with great danger to workmen from the fumes, which caused necrosis of the jaw. Many persons were poisoned from carelessness in handling these matches, and many conflagrations occurred on account of the ease with which they ignited. The "parlor match" (name significant that other matches were hardly suitable for that section of the house) really began with the manufacture, in 1848, of Schrötter's red or amorphous phosphorus. This product is of a scarlet-red color, has neither odor nor taste, is not poisonous, so far as is known, and does not take fire at ordinary temperatures. It is said, however, to absorb moisture from the atmosphere. There are many formulas for the composition of matches at present used by manufacturers that give good results.

The latest important invention in matches secures the separation of the chemicals, which, in combination, are always more or less dangerous. The safety-match was invented by a Swede named Lundstrom, at Jöndköping, Sweden, in 1855 or 1856. The head of the safety-match contains chlorate of potash and sulphur, while the friction-paper is spread with a paste of amorphous phosphorus and antimony. This is a return to first principles as shown in the splints and acid of the "light box."

There are many varieties of matches now in vogue. The most notable are the "Vestas," of which the splint is waxed cord; "fusees," for lighting in a wind, with a thick, short splint tipped with a large mass of chlorate of potash composition; "natural gas" matches, with a very long splint for lighting natural-gas fires. Besides these there are as many brands of matches as of cigars.

## PRODUCTION OF MATCHES.

What was formerly a small industry, or the domestic duty of the "handy" boy, has grown to a manufacture of enormous and rapidly increasing proportions. Electricity, however, seems destined to limit the use of matches as it does other methods of illumination. The use of matches and of gas increases perhaps in a greater ratio than the spread of the electric light, so that it will be a long conflict between them for supremacy.

The manufacture of splints in great quantities began with the invention of Reuben Partridge's splint-cutting machine. Previously matches had been split by hand by means of a collection of blades. Block or slab matches, common 20 years ago, were cut with a tool in such a way as to leave the splints in a bunch, attached together at some distance above the lower ends.* The whole bunch was dipped in sulphur-chlorate composition and the matches could be separated at will. Often the whole bunch took fire upon the separation of a single match, destroying them almost instantly. Modern splints are cut and forced through dies to give them a round shape.

At present, splint-cutting is a separate industry; the splints are sold by the hogshead at the match factories, and one machine will cut ten millions a day.

## V.—OPTICAL METHODS.

The powers of the lens and the hollow mirror have been known for ages by the civilized nations around the Mediterranean. In the classics of Greece and Rome there are allusions to the employment of mirrors and lenses for producing fire.† Wherever plane mirrors were known, probably concave focusing mirrors had been discovered. Among the several ways of producing "pure" fire the mirror and lens presented a worthy method to those ancient cultured nations possessing instruments for focusing light. It can scarcely be said that this was a widespread and popular plan for producing fire, but probably was a thing known to priests and scientific men of the day, and viewed as a mystery or curiosity.

The writer has seen hunters use the "burning glass" to light pipe or fire, and has heard of many cases where it was brought into requisition in the absence of matches, the object glass of a telescope often furnishing the lens. However, this method was very limited, and was pursued in defiance of "better light."

## VI.—ELECTRICAL METHODS.

Up to 10 years ago scarcely anything had been accomplished toward applying this new and rapidly widening feature of our era to the communication of a spark for starting a light. Strangely enough, Volta tric spark was made to ignite hydrogen gas. He also invented an electric pistol on the same principle. This hydrogen lighter was an application about 100 years in advance. It is interesting to note that the introduction of gas illumination prevalent in this country rendered this minor adaptation of electricity practicable in the same way that Volta proceeded.

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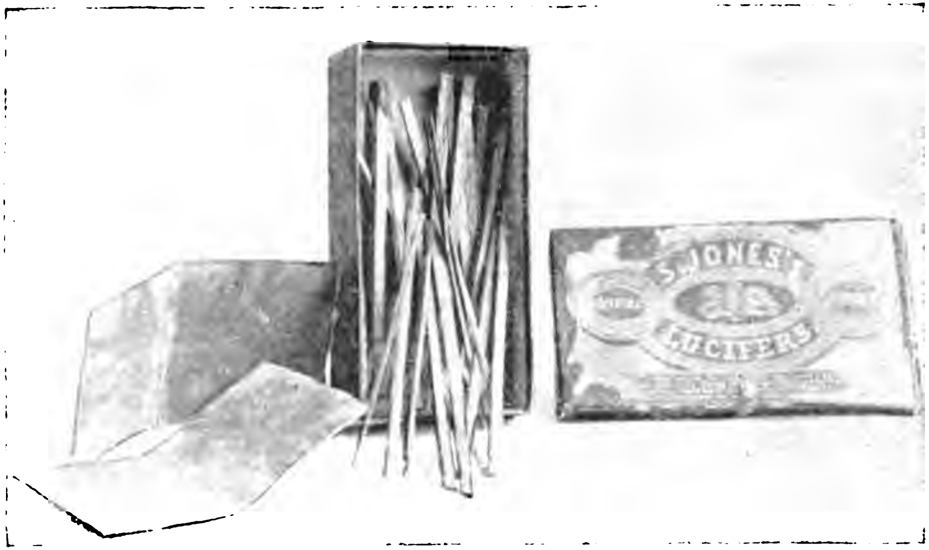
* See Fig. 13.

† M. H. Morgan. De Ignis Eliciendi Modis Apud Antiquos. Harvard Studies in Classical Philology, Vol. I, pp. 1-64. This is a complete presentation and discussion of what the classics preserve with regard to the methods of making fire among the ancients.

Lighting gas by electricity has been accomplished for some years, and is now becoming more and more common, and will perhaps be widely used before electrical lighting shall supplant other methods, as has been assumed by some writers.

Recently the gas jets of most of the large audience rooms, theaters, churches, etc., of this country are lighted by electricity at the pressure of a button. In residences with modern improvements gas can be lighted or extinguished in the halls and rooms on different floors from a switchboard situated at a convenient location.

No practicable portable electrical lighter has yet been devised.



THE FIRST FRICTION-MATCH, OR LUCIFER, "LOCO FOCO."

From a photograph (Cat. No. 129973, U. S. N. M.) of an original box in the Essex Institute, Salem, Massachusetts

# THE ULU, OR WOMAN'S KNIFE, OF THE ESKIMO.

By Otis T. Mason.

The apparatus described in this paper finds its modern representative in the saddler's knife, the shoemaker's knife, the tailor's shears, the butcher's knife, the fishmonger's knife, and the kitchen knife. A curious survival of form with change of function is the common kitchen "chopping knife," which woman may be said to have held in her possession since the birth of invention. This little instrument that has ever attended the march of civilization is called "ulu," or "ooloo," by the Eskimo, or more commonly the "woman's knife."

It is well to recall in this connection that in savagery the peaceful arts, such as housemaking, furnishing, tailoring, butchering, gleaning, milling, cooking, spinning, netting, weaving, and the like, belong to women. Many of the stone implements and pottery vessels recovered from the mounds and graves are found with skeletons of females. In the study of culture, therefore, the work of women can not be overlooked.

The motive for bringing together this series of objects, however, is to show how, by means of a very simple form or invention, some of the most difficult problems of anthropology may be discussed. They will be taken up in the following order:

(1) Among the same race or stock, and in the same period, there are varieties of form, structure, and decoration, peculiar to separate culture areas.

(2) Upon the simplest as upon the most complicated appliance of human activity the earth and its productions leave unmistakable impressions.

(3) The coarseness or refinement of a tribe or location is revealed in the tools of the commonest occupation.

(4) The arts and apparatus of savagery are continued into civilization, and with change of name or function retain some of their original form.

There are a great many examples of the Ulu in the National Museum, and there are thousands of pieces of slate, shale, quartzite, and other stone which correspond exactly with the blades of the Eskimo woman's knife. These have been gathered from village sites, shell heaps, the surface of the soil, from graves, mounds, and Indian camps in countless numbers. This need surprise no one who reflects that every woman indispensable implements. To conceive of a savage without a knife is to conceive of man before he held the simplest invention in his hand with which to help himself.

The simplest form of knife is a flake or spall of flinty or glassy material knocked from a stone or a core so as to preserve a cutting edge. A few knives from Point Barrow are of this very primitive character, but these really are not within the class here described; the ulu as it nowadays exists is a complex affair, consisting of a blade and a handle or grip with or without some form of lashing. The blade is either a thin piece of slate ground to an edge, a bit of cherty or flinty rock chipped to an edge, a scrap of steel or iron from wrecks of whaling vessels, or good blades made and sold to the Eskimo by traders who visit their country (Pl. LII to LXXII).

The handle of this common implement varies greatly in material, form, and finish. In form alone the specimens from each typical area are unique. So much so that one who has handled a great many of them finds no difficulty in relegating a stray example to its proper companionships.

In the matter of attaching the blade to the handle or grip the Eskimo's mother wit has not deserted her. Many of the blades are tightly fitted into a socket or groove of the handle. Boas, who lived among the Cumberland Gulf Eskimo, tells us that glue is made of a mixture of seal's blood, a kind of clay, and dog's hair (Rep. Bur. Ethnol., VI, 526).

Among the western Eskimo it is quite common to cut a hole through the blade and the handle and to fasten the two together by a sewing or lashing of rawhide, whalebone, pine root, or sinew cord. There is one specimen with a grip of a still more primitive character. The solid handle is replaced by a basketwork of spruce root woven around the thick upper portion of the blade (Pl. LXI, fig. 1.) Archæologists are especially asked to note this device, explaining how a grip may be provided by ingenious savages even when a mortise is impracticable.

In this chapter, as in others devoted to the Eskimo, it is found convenient to divide the American Hyperborean region into the following culture areas: Labrador and Ungava (Pl. LV, Fig. 3); Greenland (Pl. LII, LIII, LIV, Fig. 1); Baffin Land (Pl. LIV, Figs. 2 and 3, Pl. LV, Figs. 1 and 2); Mackenzie River District (Pl. LVI and Pl. LVII, Fig. 1); Point Barrow (Pl. LVII, Figs. 2 and 3, Pl. LVIII, Pl. LIX); Kotzebue Sound (Pl. LX and LXI, Figs. 1 and 2); Sledge Island, St. Lawrence Island, and Asiatic side (Pl. LXI, Fig. 3, Pl. LXII, Figs. 1 and 2; Norton Sound and Yukon District (Pl. LXII, Fig. 3, Pl. LXIII, LXIV, LXV, LXVI); Nunivak Island and mainland, and Kuskokvim mouth (Pl. LXVII Figs. 2 and 3); Bristol Bay, Peninsula of Alaska, Kadiak and vicinity (Pl. LXVIII to LXXI, Figs. 1 and 2); Indians of Southeast Alaska (Pl. LXXI, Fig. 3, Pl. LXXII.) Some of these are further divided by types and forms of objects.

## II.—REGIONAL INFLUENCES.

It is too well known to be argued that there are certain great culture areas on the earth, where man himself and all that he creates are fitted to natural conditions distinct enough to give form and color to everything. The Eskimo land is one of these culture areas. It may have escaped observation, however, that in these limits there are often subdivisions or sub-areas which impress a still more definite and distinct mark on man and his civilization.

The woman's knife is found throughout the Eskimo region, from Labrador to Kadiak. Some portions of this hyperborean strip have long been under the influence of the missionary, the trader, and the fisherman, and their part in determining the structure of the ulu will soon be made to appear. But the alternation of slate and chert in the blade is governed by natural conditions, the abundance of the material in the vicinity. A possibility of traffic must always be allowed for; but in a large number of implements of this kind, if they were classed by the material of the blade, the localities would not be very badly mixed. But, failing in this, the handle or grip comes to the help of the student. If this be made of antler we are somewhere within the limits of the moose or the reindeer. In the Hudson Bay region some of the handles are of musk-ox horn, a thing possible in great numbers only where this creature abounds. And, *vice versa*, the presence of the musk ox may be based upon the occurrence of implements made of the horn. Walrus-ivory handles not only indicate the presence of the walrus at any given point, but in a great collection like that in the National Museum, the abundance and accessibility of the walrus are indicated by the diffusion of the specimens. A great many handles of wood in the south of Alaska speak with sufficient clearness of the fact that this material is more abundant in some localities than in others.

## III.—DEGREES OF REFINEMENT.

The Eskimo furnish the best of all the remaining uncivilized areas for the examination of the grade and kind of civilization possessed by any people as indicated by their arts. Some of the ulus in the National Museum are as coarse as savagery could make them; others are very beautiful. Indeed the same locality furnishes both and intervening kinds, due, without doubt, to individual ability or personality. But some areas furnish only coarse work, while others supply the most beautiful. The problem is a complex one, and must be studied with caution. White influence has crept in to embarrass the question, giving the following classes of results:

(1) Knives made out and out by white men and sold to the Eskimo, having blades of steel riveted into handles of antler cut by machinery.

(2) Specimens made apparently partly by the ship's blacksmith and partly by the native, a kind of joint production.

(3) Specimens made from iron, wood, and other materials gathered from wrecks. The art in this case is more decidedly native than it is in Nos. 1 and 2.

(4) Specimens made of native material, but the carving on the handles was done with iron or steel blades set in native handles. This form of ulus marks a very peculiar phase of contact between savagery and civilization, worthy of careful study by all technologists and archæologists. To be more explicit, when the voyageurs and explorers entered the fur-producing sections of our continent in the sixteenth century, they made no attempt to change a single industry or social structure of the aborigines. They only sought to profit by their native arts, and in order to do so simply removed the stone arrow point to substitute one of hoop-iron, or replaced the bow by a better implement, the rifle. If at the same time the traders brought steel-bladed pocket knives, steel files, and a few other primitive tools, and if at this period the natives were still building mounds and carving stone, then we could easily account for the more refined pipes and other artefacts which seem to point to a knowledge of steel, without recourse to the suspicion of fraudulent manufacture. At any rate, the art of ivory carving bloomed out among the Eskimo on the acquisition of steel carving tools. The Russian fur traders and the Hudson Bay factors have been always careful to preserve the native in his simplicity and to break up his manner of living as little as possible. When this golden mean was transcended the native art began to decay. The most intelligent and skillful were won over to the higher arts of the cultured races and the older arts were left to languish in the suburbs even of barbarism.

(5) Specimens entirely native in material and workmanship. These are the rare specimens, frequently old, mostly from out of the way places and not of the highest finish. The limitations are those incident to the poorer tools of savagery. They have blades of polished slate or chipped stone; handles of wood, bone, ivory or antler; glue of native manufacture or lashing of spruce root, rawhide, or sinew.

## IV.—SURVIVALS.

The ulu is found in civilization under two well-known forms, the saddler's knife and the kitchen knife.

The saddler's knife may be seen in the hands of a workman on the Epyptian monuments (Pl. LII, Fig. 1), showing that very early in the history of industry, just as soon as a sufficient number of men could be relieved from the function of weapon bearing, they little by little assumed some of the more masculine of woman's occupations. It is just as if the woman of an advancing people had taught the man to work in leather and had then passed over to him the apparatus of the craft. It is worthy of notice that the shoemaker has repudiated the ulu form and the cutting from him and has adopted the common knife. The saddler perpetuates for cutting leather an implement designed to be used with skins from which the hair has not been removed.

The kitchen chopper represents a very different conception, no less than the continuation of a structure with great modification of function. It is still the woman's knife deprived of nearly all its ancient and primitive offices, consigned to a single one which it scarcely had at the beginning. From this we are led to the reflection that it is easier to change the culture of women than the culture of men. Civilization lifts up savagery almost exclusively through women. Men go down in the struggle, can not learn occupations diametrically opposite to those they have been pursuing, and occupations which through generations they have considered degrading.

## LIST OF SPECIMENS ON WHICH THIS INVESTIGATION WAS BASED.

From the foundation of the National Museum many friends have brought specimens from the Eskimo region. The obligations of every student are due and can not be too emphatically expressed to Fenckner, Bessels, Turner, Kumlien, Müntzer, Boas, Hall, McFarlane, Ross, Kennicott, Ray, Murdoch, Herendeen, Stoney, Baker, Dall, Elliott, Nelson, Applegate, Johnson, Fisher, McLean, Swan, and others not now recalled. The Alaska Commercial Company has lost no opportunity to help in the matter and has gathered on the west coast one of the best series of Eskimo objects in the world. The accompanying list does not include every specimen in the museum; it embraces only those on which this investigation was based.

| Mus. Cat. No. | Locality. | By whom collected. |
|---|---|---|
| 1630 | Anderson River | McFarlane. |
| 2272 | do | Do. |
| 5813 (440) | McKenzie, Anderson River. | Do. |
| 7419 | Fort Anderson | Do. |
| 10215 (21) | Repulse Bay | Hall. |
| 20844 | Kootznoo Indians | Swan. |
| 24353 | Norton Island | Turner. |
| 24365 | do | Do. |
| 24365 | St. Michaels | L. M. Turner. |
| 24376 | do | Turner. |
|  | Cumberland Gulf. |  |
| 29973 | do | W. A. Mintzer. |
| 33628 | St. Michaels | Nelson. |
| 33744 | do : | Do. |
| 33745 | St. Michaels | Do. |
| 33766 | Norton Sound | Do. |
| 36316 | Kongigre | Do. |
| 37327 | Aginkchuguluk | Do. |
| 37741 | Kongig | Do. |
| 37960 | Ifagamut | Do. |
| 38129 | Nulokh | Do. |
| 38255 | L. Yukon River | Nelson. |
| 38366 | Newlukh | Do. |
| 43432 | St. Michaels | Do. |
| 43866 | Unalakleet | Do. |
| 43959 | Nubviakchuliak | Do. |
| 44180 | Cape Darby | Do. |
| 44598 | Cape Nome | Do. |
| 45469 | St. Michaels | Do. |
| 46256 | Plover Bay | Dall. |
| 48257 | Nunivak | Nelson. |
| 48823 | Rasb. Yukon | Do. |
| (7168)<br>48841 | do | Do. |
| (7168)<br>48831 | do | Do. |
| 55916 | Bristol Bay | McKay. |
| 55916 | do | Do. |
| 55918 | do | Do. |
| 55918 | do | Do. |
| 55918 | do | Do. |
| 56660 | Point Barrow | Ray. |
| 63765 | Hotham Inlet | Nelson. |

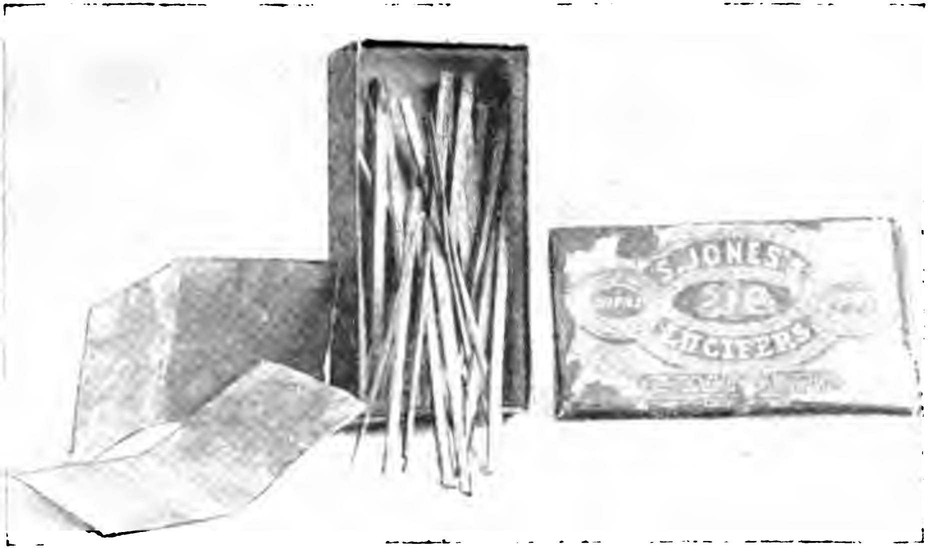
| Mus. Cat. No. | Locality. | By whom collected. | Mus. Cat. No. | Locality. | By whom collected. |
|---|---|---|---|---|---|
| 63766 | Hotham Inlet..... | Nelson. | 89685 | Point Barrow..... | Ray. |
| 63916 | Greenland ....... | Finuker. | 89687 | ....do ............. | Do. |
| 63919 | ....do ............. | Do. | 89688 | ....do ............. | Do. |
| 72510 | Kadiak ........... | Fisher. | 89689 | ....do ............. | Do. |
| 72511 | Kadiak (?) Orlova. | Do. | 89690 | ....do ............. | Do. |
| 74362 | Sitka ............. | McLean. | 90259 | Ungava .......... | Turner. |
| 75496 | Kotzebue Island. | Stoney. | 90409 | Bristol Bay ....... | Fisher. |
| 75497 | ....do ............. | Do. | 90410 | Kodiak ........... | Do. |
| 75497 | ....do ....... .... | Do. | 90412 | ....do ............. | Do. |
| 76676 | Cape Lisburne .. | H. D. Woolfe. | 127008 | St. Lawrence Island. | Nelson. |
| 88678 | Point Barrow ..... |  |  |  |  |
| 88772 | British Columbia. | Swan. | 127043 | Smith Island...... | Dr. E. Bessels. |
| 89594 | Point Barrow ... | Ray. | 127382 | Togiak River..... | Applegate. |
| 89645–46 | ....do ............. | Do. | 127380 | Igushek River.... | Do. |
| 89675 | ....do ............. | Do. | 127725 | Fort Wrangel .... | Fisher. |
| 89677 | ....do ............. | Do. | 127735 | Ugashk........... | Do. |
| 89684 | Point Barrow.... | Do. | 130617 | Kuskokvim River | C. Adler. |

## EXPLANATION OF PLATE LII.

### EGYPTIAN LEATHER-WORKER, AND EAST GREENLAND ULUS.

Fig. 1. An Egyptian leather-worker using the "saddler's knife" or saddler's ulu. From Wilkinson.

Figs. 2, 3, and 4. East Greenland form of ulu, from Holm's Ethnographic Sketch, Pl. XIX, to be compared with Mackenzie River type, Pl. V of this paper. Both show contact with European whalers and fur traders.



THE FIRST FRICTION-MATCH, OR LUCIFER, "LOCO FOCO."

From a photograph (Cat. No. 129973, U. S. N. M.) of an original box in the Essex Institute, Salem, Massachusetts

## EXPLANATION OF PLATE LIII.

### GREENLAND ULUS, OR WOMAN'S KNIVES.

Fig. 1. Ulu from East Greenland, to be compared with Pl. III and IV of this work. From Holm's Ethnographic Sketch, Pl. XIX.

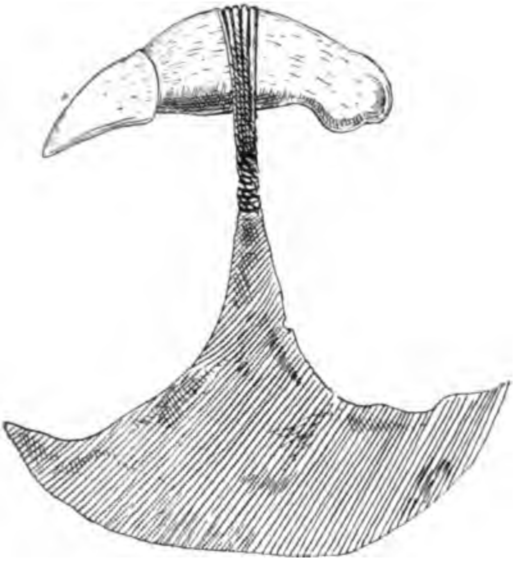
Fig. 2. WOMAN'S KNIFE (ULU). Blade of iron in form of the bottom of a bell, inserted in a groove of the walrus ivory handle. The latter is in two pieces sewed together with sinew thread, its upper portion projecting at the ends. Width of blade 3 inches.

Cat. No. 127043, U. S. N. M. Eskimo of Smith Sound, Greenland. Gift of Governor Fencker.

Fig. 3. WOMAN'S KNIFE (ULU). Blade of iron in form of a vertical segment of a bell, inserted in a groove of the decayed ivory handle. Handle, 1⅝ inches; blade, 1¾ inches.

Cat. No. 63919, U. S. N. M. Eskimo of Upernavik, Greenland, 1882. Gift of Governor Fencker.

PLATE LIII.



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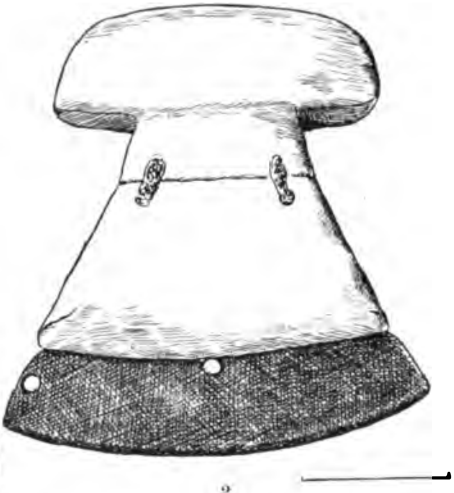
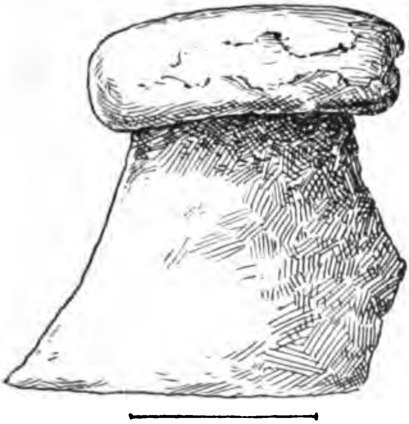


2



3

GREENLAND ULUS, OR WOMAN'S KNIVES.

## EXPLANATION OF PLATE LIV.

### ULUS, OR WOMAN'S KNIVES, OF CUMBERLAND GULF.

Fig. 1. **Woman's Knife (ulu).** Blade of iron in form of a segment of a circle, with a slender stem inserted in a spindle-form handle of ivory. Blade, 5 inches; stem, 2¾ inches.

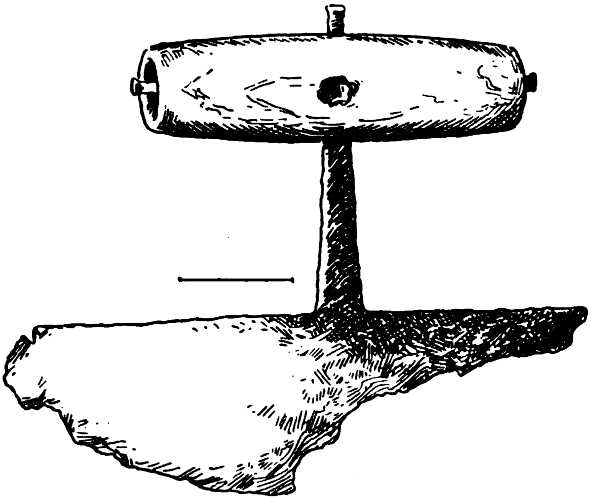
Cat. No. 63916. U. S. N. M. Upernavik, Greenland, 1882. Gift of Governor Fencker.

Fig. 2. **Woman,s Knife (ulu).** Blade slightly crescent-shaped, riveted to the iron stem one side by means of three iron rivets. The grip is of oak, probably from a whale ship. The smithing is very rude. Length of blade, 5⅛ inches.

Cat. No. 29973, U. S. N. M. Eskimo of Cumberland Gulf, 1876. Collected by Lieut. W. T. Mintzer.

Fig. 3. **Woman's Knife (ulu).** Blade of iron, slender. the two ends resembling bowie-knife points. This is riveted to a plate of iron serving as a stem driven through a handle of oak. Rude smithing characteristic of this area. Length of blade, 4¼ inches.

Cat. No. 29973 (*a*), U. S. N. M. Eskimo of Cumberland Gulf. Collected by Lieut. W. T. Mintzer.



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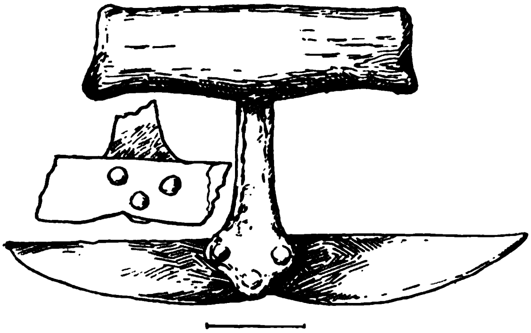

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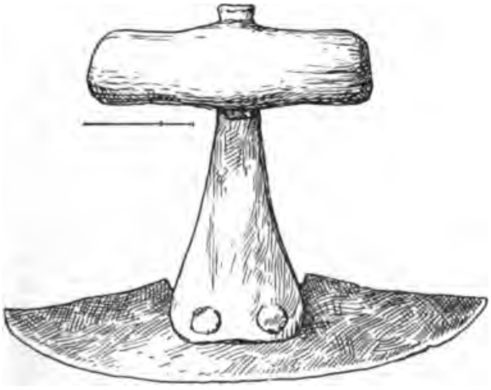

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ULUS, OR WOMAN'S KNIVES, OF CUMBERLAND GULF.

## EXPLANATION OF PLATE LV.

### ULUS, OR WOMAN'S KNIVES, FROM NORTHEAST CANADA.

Fig. 1. **WOMAN'S KNIFE** (ULU). Blade bell-shaped, riveted into a deep groove of the ivory base of the handle. The handle consists of three parts, the grip of musk-ox horn, the stem of antler inserted into the grip and sewed with sinew thread to the blade piece. Length of knife, 4½ inches.

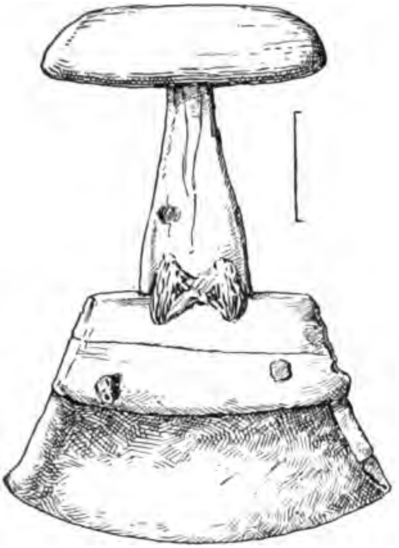
Cat. No. 10411, U. S. N. M. Pelly Bay, 1871. Collected by Capt. C. F. Hall.

Fig. 2. **WOMAN'S KNIFE** (ULU). Blade of iron, fan-shaped, riveted to the iron stem on one side with four copper and one iron rivets. Upper end of stem driven into a grip of musk-ox horn. A very graceful piece, the sides of the blade were roughly cut with a cold chisel or file, perhaps by a whaling ship's carpenter. Length, 4 inches.

Cat. No. 10215, U. S. N. M. Igloolik Eskimo, 1871. Collected by Capt. C. F. Hall.

Fig. 3. **WOMAN'S KNIFE** (ULU). Blade crescent-shaped, fastened in the stem of the handle of antler by an iron rivet. The grip of the handle resembles closely the shape of the blade. Width of blade, 2½ inches.

Cat. No. 90259, U. S. N. M. Eskimo of Ungava, Canada, 1884. Collected by Lucien M. Turner.



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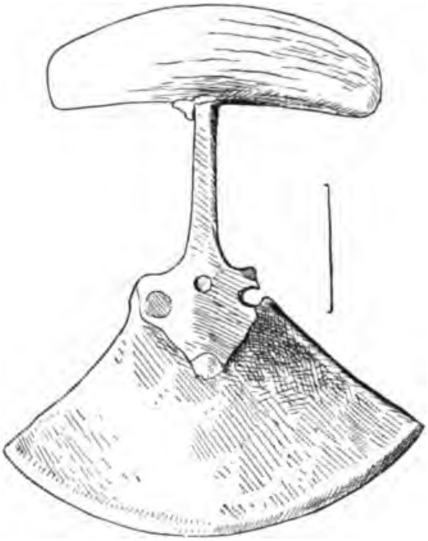

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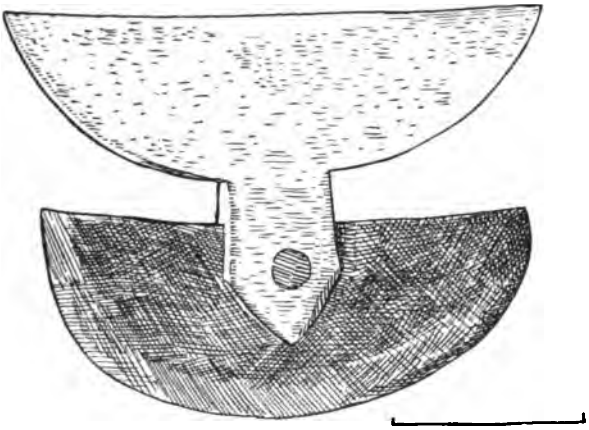

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ULUS, OR WOMAN'S KNIVES, FROM NORTHEAST CANADA.

## EXPLANATION OF PLATE LVI.

### ULUS, OR WOMAN'S KNIVES, FROM MACKENZIE DISTRICT.

Fig. 1. WOMAN'S KNIFE (ULU). Blade of iron, bell-shaped, the upper margin riveted to two stems of antler, the latter passing through mortises in the handle or grip. The specimen copies very closely the modern chopper knife. Width of blade, 4½ inches.

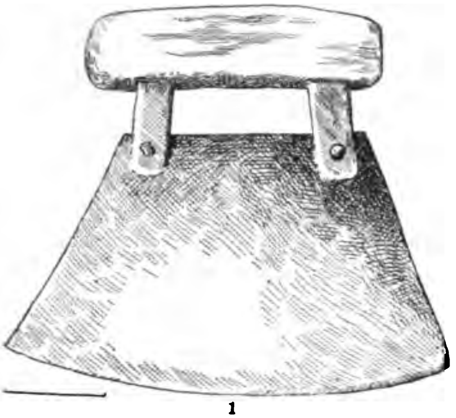
Cat. No. 2272, U. S. N. M. Eskimo of Anderson River, N. W. Canada. Gift of R. McFarlane.

Fig. 2. WOMAN'S KNIFE (ULU). Blade of iron, trapezoidal, fastened by means of two copper rivets into a handle of walrus ivory. The handle is pierced by a double row of holes on its upper margin for a lacing of whalebone. Width of blade, 5¼ inches.

Cat. No. 7419, U. S. N. M. Eskimo of Fort Anderson. Gift of R. McFarlane.

Fig. 3. WOMAN'S KNIFE (ULU). Blade of sheet iron, inserted without rivets into a slit in the handle of walrus ivory. The latter is excavated on both sides to fit the hand, and ornamented with whalebone placed through perforations in the upper border with slight variations. Nos. 5813 and 7419 are of similar style. Width of blade, 5 inches.

Cat. No. 1630, U. S. N. M. Eskimo of Fort Anderson, N. W. Canada, 1864. Gift of R. McFarlane.



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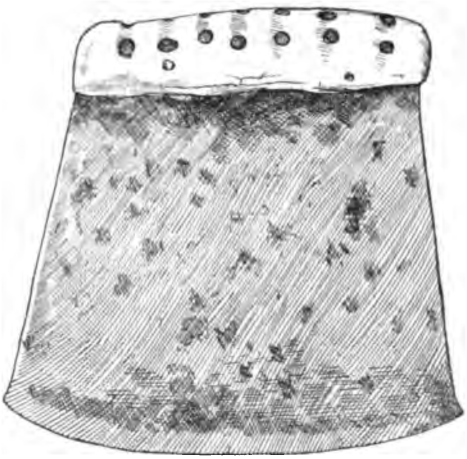

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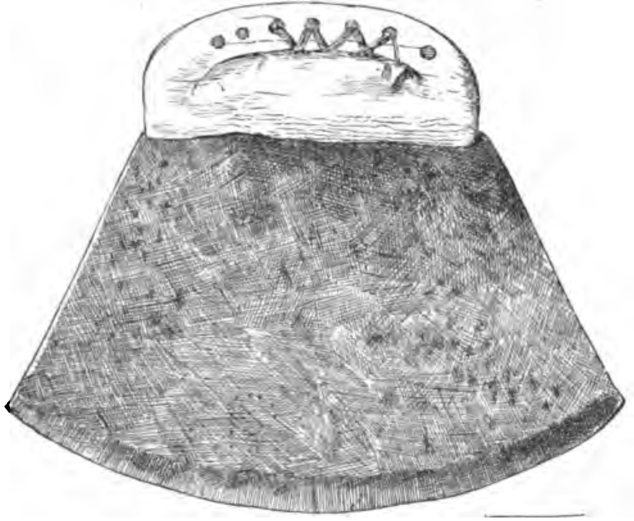

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ULUS, OR WOMAN'S KNIVES, FROM MACKENZIE DISTRICT.

## EXPLANATION OF PLATE LVII.

### ULUS, OR WOMAN'S KNIVES, FROM NORTHERN ALASKA.

Fig. 1. WOMAN'S KNIFE (ULU). Blade of iron, trapezoidal in shape, inserted in a groove in a handle of walrus ivory, the upper borders of which are perforated and adorned with lacing of whalebone. A double cone perforation serves for suspension strings. Width of blade, 3 inches.

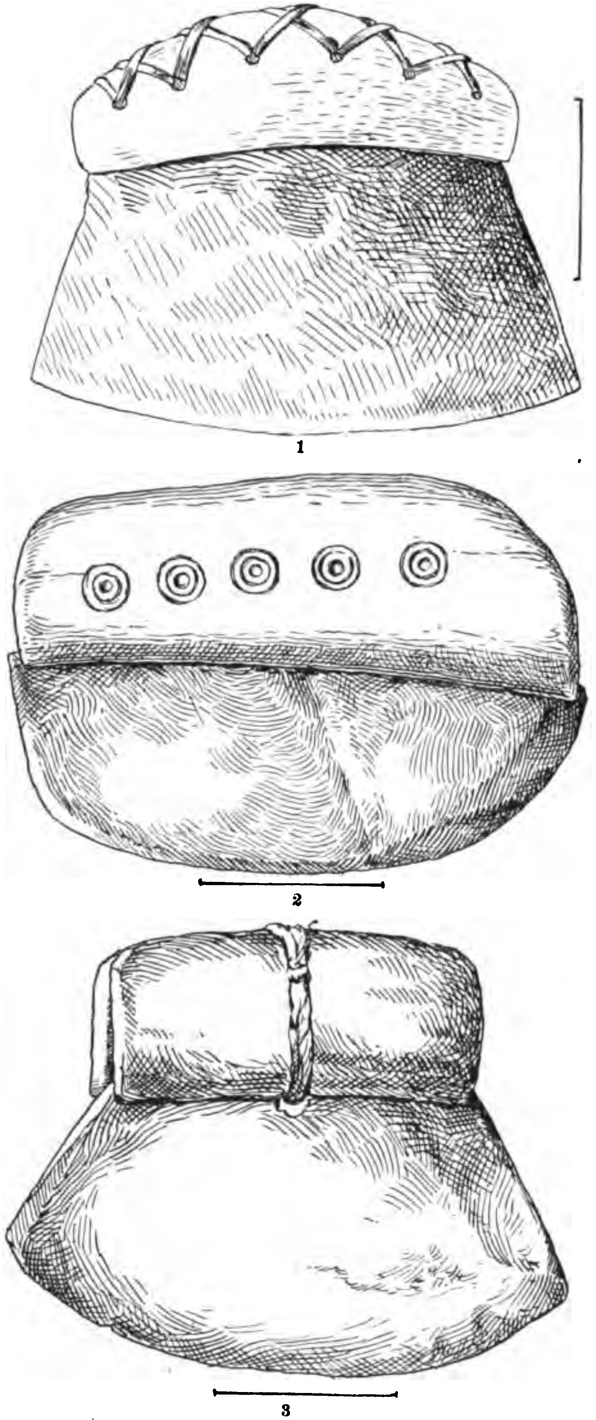
Cat. No. 5813, U. S. N. M. Eskimo of the mouth of Mackenzie River. Gift of R. McFarlane.

Fig. 2. WOMAN'S KNIFE (ULU). Blade of drab slate, set in groove of walrus ivory handle. There are five ornaments on each side of the latter, made each of a dot and two concentric rings. Width of blade, 3 inches.

Cat. No. 89687, U. S. N. M. Eskimo of Point Barrow, Alaska, 1884. Collected by Capt. P. H. Ray, U. S. A.

Fig. 3. WOMAN'S KNIFE (ULU). Blade of drab slate, in a handle of antler. The handle consists of two separate pieces lashed together and held to the blade by the sinew passing through the hole in the upper margin. Width of blade, 3 inches.

Cat. No. 89688. U. S. N. M. Eskimo of Point Barrow, Alaska, 1884. Collected by Capt. P. H. Ray, U. S. A.



ULUS, OR WOMAN'S KNIVES, FROM NORTHERN ALASKA.

## EXPLANATION OF PLATE LVIII.

### ULUS, OR WOMAN'S KNIVES, FROM NORTHERN ALASKA.

Fig. 1. **WOMAN'S KNIFE (ULU).** Blade of hornstone, leaf-shaped in outline excepting that upon one margin an angular projection extends upward for a tang driven into the end of a bit of antler which serves for a grip. Contrary to the usual method, the tang is driven into the grain of the antler at the end. Width of blade, 3 inches.

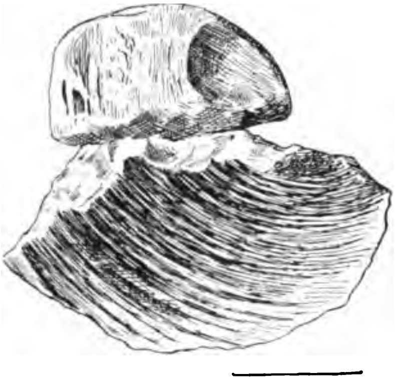
Cat. No. 89690, U. S. N. M. Eskimo of Point Barrow, Alaska, 1884. Collected by Capt. P. H. Ray, U. S. A.

Fig. 2. **WOMAN'S KNIFE (ULU).** Blade of drab slate, irregularly triangular, driven into a groove of a bit of antler. The mending of the handle by means of sinew lashing is noteworthy. Width of blade, 3 inches.

Cat. No. 89689, U. S. N. M. Eskimo of Point Barrow, Alaska, 1884. Collected by Capt. P. H. Ray, U. S. A.

Fig. 3. **WOMAN'S KNIFE (ULU).** Blade of slate, an irregular triangle inserted into a cut in a handle of bone, which is carved into the shape of a fish's tail, heterocercal. Length, 5¼ inches.

Cat. No. 89677, U. S. N. M. Eskimo of Point Barrow, Alaska, 1884. Collected by Capt. P. H. Ray. U. S. A.



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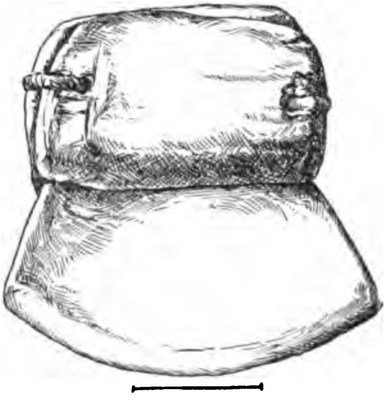

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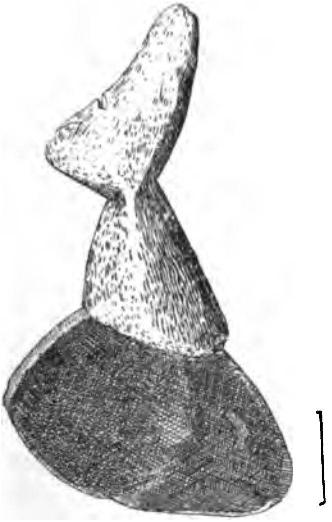

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ULUS, OR WOMAN'S KNIVES, FROM NORTHERN ALASKA.

## EXPLANATION OF PLATE LIX.

### ULUS OR WOMAN'S KNIVES, FROM NORTHERN ALASKA.

Fig. 1. **WOMAN'S KNIFE (ULU).** Blade of slate, somewhat cleaver-shaped and pointed. The tang at the end of the blade is a parallelogram inserted in a deep cut in the handle of whale rib. A lashing of rawhide holds the blade in place, which also has a packing of skin. Length, 9 inches.

Cat. No. 89594, U. S. N. M. Eskimo of Point Barrow, Alaska, 1884. Collected by Capt. P. H. Ray, U.S. A.

FIG. 2. **WOMAN'S KNIFE (ULU).** Blade of slate, set in a groove of a handle of bone, one side split off, to which the handle is fastened by a lashing of rawhide passing through a perforation in each. A larger hole receives a string for suspension. Length of handle, 4¾ inches.

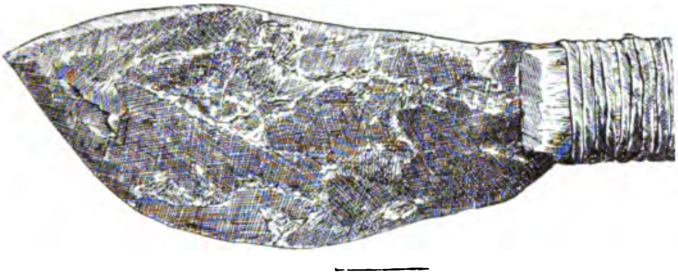
Cat. No. 89684, U. S. N. M. Eskimo of Point Barrow, Alaska, 1884.

Fig. 3. **WOMAN'S KNIFE (ULU).** Blade of pectolite, long and slender, showing on the straight back the double saw-cut by which the material was separated. Handle wanting. Length, 7¼ inches.

Cat. No. 56660, U. S. N. M. Eskimo of Point Barrow, Alaska, 1884. Collected by Capt. P. H. Ray, U. S. A.

Fig. 4. **WOMAN'S KNIFE (ULU).** Blade of pectolite, the special form of jades in this region. Handle wanting. Length, 4⅜ inches.

Cat. No. 89675, U. S. N. M. Eskimo of Point Barrow, Alaska, 1884. Collected by Capt. P. H. Ray, U. S. A.



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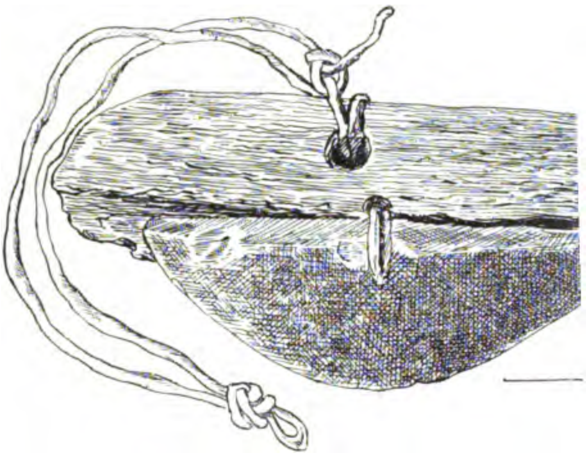

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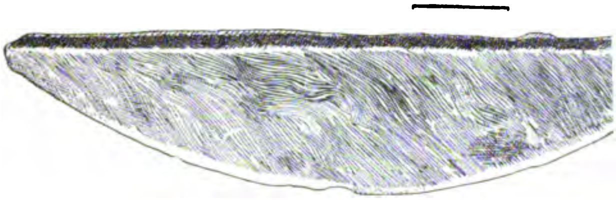

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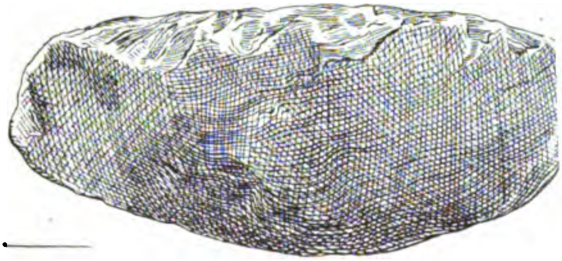

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ULUS, OR WOMAN'S KNIVES, FROM NORTHERN ALASKA.

## EXPLANATION OF PLATE LX.

### ULUS, OR WOMAN'S KNIVES, FROM KOTZEBUE SOUND.

Fig. 1. WOMAN'S KNIFE (ULU). Blade of iron, quadrant-shaped, inserted firmly into a short handle or grip of musk-ox horn. Width of blade, 5⅞ inches.

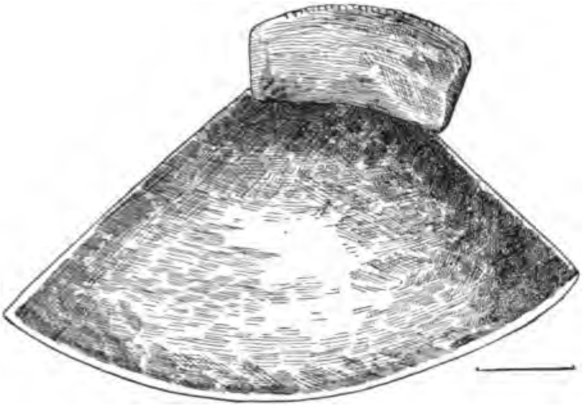
Cat. No. 75496, U. S. N. M. Eskimo of Kotzebue Sound, 1884. Collected by Lieut. G. M. Stoney, U. S. N.

Fig. 2. WOMAN'S KNIFE (ULU). Blade of hornstone, fan-shaped. Handle wanting. Width, 3½ inches.

Cat. No. 75497, U. S. N. M. Eskimo of Kotzebue Sound, 1884. Collected by Lieut. G. M. Stoney, U. S. N.

Fig. 3. WOMAN'S KNIFE (ULU). Blade of jadeite, thin and highly polished. set in a pine handle, which is altogether modern. Length, 6¼ inches.

Cat. No. 76676, U. S. N M. Eskimo of Cape Lisburne, Alaska. Collected by H. D. Woolfe.



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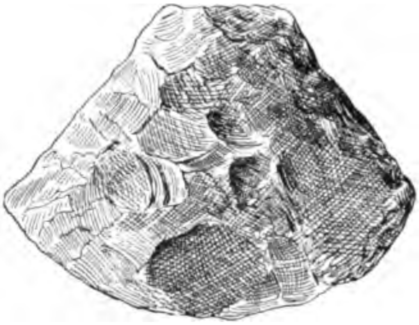

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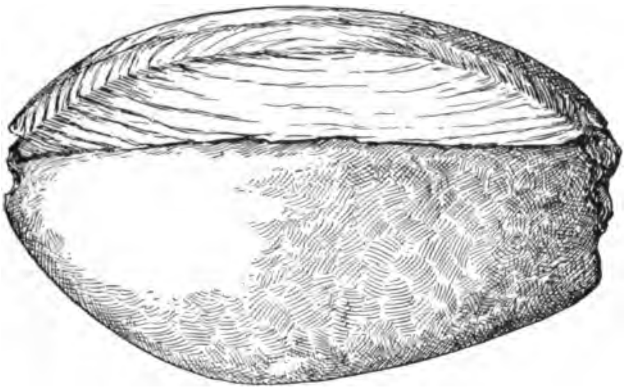

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ULUS, OR WOMAN'S KNIVES, FROM KOTZEBUE SOUND.

## EXPLANATION OF PLATE LXI.

### ULUS, OR WOMAN'S KNIVES, FROM HOTHAM INLET AND CAPE NOME.

Fig. 1. **WOMAN'S KNIFE** (ULU). Blade of hornstone, leaf-shaped, with a projection from one margin. The handle is of the most primitive character, being formed of osier, wrapped backward and forward longitudinally and held firmly in place by cross twining and weaving of the same material. The interstices are filled with fish scales. Length, 3¼ inches.

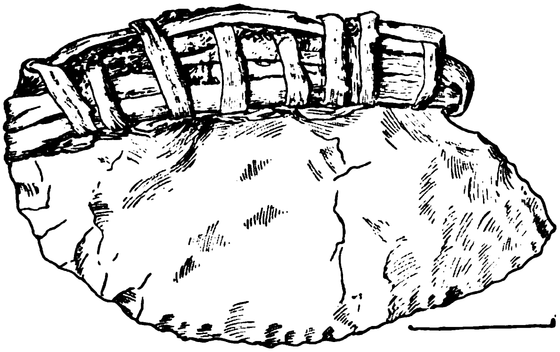
Cat. No. 63765, U. S. N. M. Eskimo of Hotham Inlet, Alaska. Collected by Lieut. G. M. Stoney, U. S. N.

Fig. 2. **WOMAN'S KNIFE** (ULU). Blade of chert or flint material, inserted in a handle of wood. On the upper margin of the latter at either corner are three cross gashes or grooves.

Cat. No. 63766, U. S. N. M. Eskimo of Hotham Inlet, Alaska. Collected by Lieut. G. M. Stoney, U. S. N.

Fig. 3. **WOMAN'S KNIFE** (ULU). Handle of walrus ivory abruptly wedge-shaped, like the kernel of a Brazil nut. Ornament, groove, and herring bone on top, lines and alternating tooth-shaped cuts on the side, with five scratches resembling inverted trees. Pocket groove for blade. Length, 2½ inches.

Cat. No. 44598, U. S. N. M. Eskimo of Cape Nome, Alaska, 1880. Collected by E. W. Nelson.



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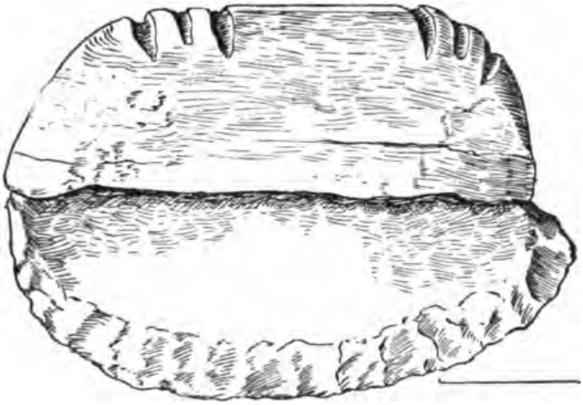

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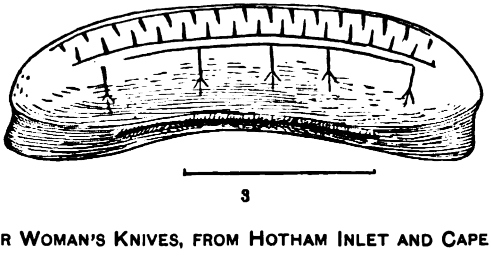

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ULUS, OR WOMAN'S KNIVES, FROM HOTHAM INLET AND CAPE NOME.

## EXPLANATION OF PLATE LXII.

### ULUS, OR WOMAN'S KNIVES, FROM PLOVER BAY. ST. LAWRENCE ISLAND, AND NORTON SOUND

Fig. 1. WOMAN'S KNIFE (ULU). Blade of iron, rectangular, inserted into a pocket groove in the handle of antler, much weathered Almost identical with specimen from St. Lawrence Island. Length of handle, 8 inches.

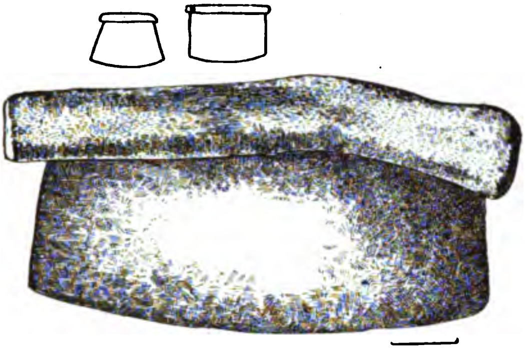
Cat. No. 46256, U. S. N. M. Eskimo of Plover Bay, Eastern Siberia. Collected by W. H. Dall.

Fig. 2. WOMAN'S KNIFE (ULU). Blade of iron, evidently not designed for the handle, set in a pocket groove twice too long for it. Handle of walrus ivory, wedge-shaped, wider in the middle. Length of handle, 4½ inches.

Cat. No. 127008, U. S. N. M. Eskimo of St. Lawrence Island, 1880. Collected by E. W. Nelson.

Fig. 3. WOMAN'S KNIFE (ULU). Blade of slate, very large, inserted in a small grooved piece of ivory and held in place by a packing of rawhide. Width of blade, 8 inches.

Cat. No. 24363, U. S. N. M. Malemut Eskimo of Norton Sound, Alaska. Collected by Lucien M. Turner.



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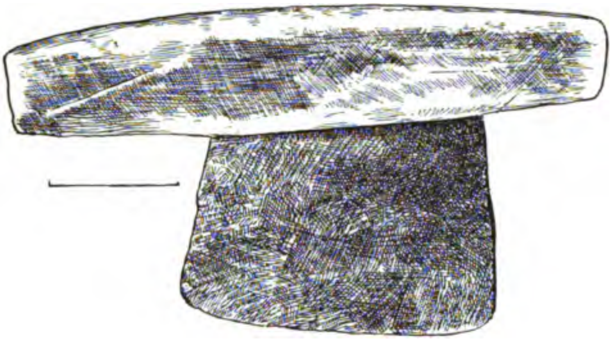

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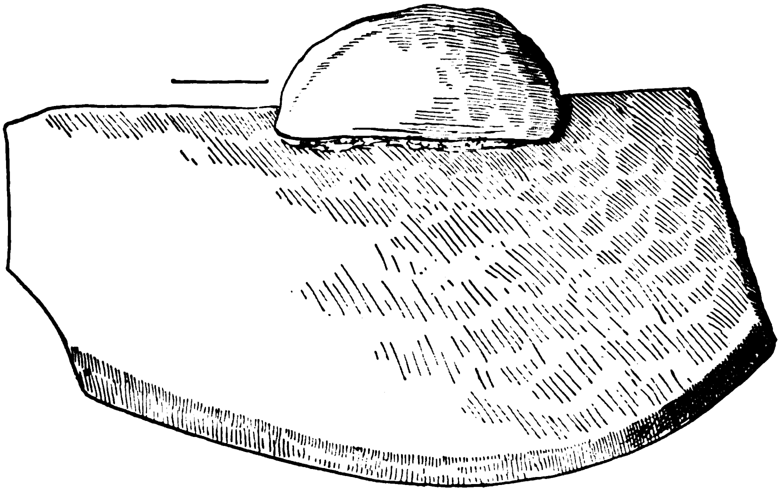

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ULUS, OR WOMAN'S KNIVES, FROM PLOVER BAY, ST. LAWRENCE ISLAND, AND NORTON SOUND.

## EXPLANATION OF PLATE LXIII.

### ULUS, OR WOMAN'S KNIVES, FROM NORTON SOUND.

Fig. 1. **WOMAN'S KNIFE (ULU).** Blade of iron, a truncated circular segment inserted in a groove in a handle of walrus ivory. The ornament around the border by alternation of points gives a funiculate effect. The hatching is poorly done. Blade 3⅜ inches.

Cat. No. 33745, U. S. N. M. Unaligmut Eskimo of St. Michaels, Alaska. Collected by E. W. Nelson.

Fig. 2. **WOMAN'S KNIFE (ULU).** Blade of dark slate, set in groove of wooden handle, the latter perforated for suspension. This specimen has never been used. Length of blade, 5½ inches.

Cat. No. 43432, U. S. N. M. Unaligmut Eskimo, St. Michaels, Alaska. Collected by E. W. Nelson.

Fig. 3. **WOMAN'S KNIFE (ULU).** Blade of slate, unsymmetrically bell-shaped, inserted in a grooved handle of soft wood. Width of blade, 3¼ inches.

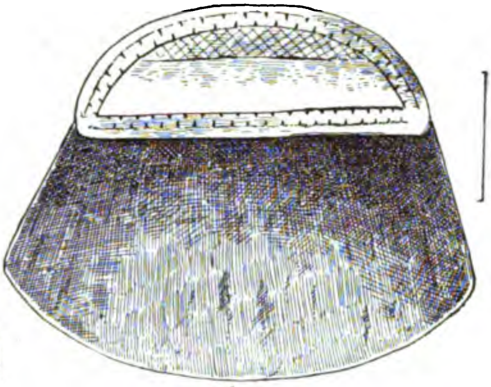
Cat. No. 33744, U. S. N. M. Unaligmut Eskimo of St. Michaels, Alaska. Collected by E. W. Nelson.

Fig. 4. **WOMAN'S KNIFE (ULU).** Blade of iron, inserted in a groove of the walrus ivory handle. The latter is beautifully colored by use and cut out in graceful curves, so as to combine perfectly lightness and strength. Width of blade, 3¼ inches.

Cat. No. 24366, U. S. N. M. Unaligmut Eskimo of St. Michaels, Alaska, 1878. Collected by Lucien M. Turner.

Fig. 5. **WOMAN'S KNIFE (ULU).** Blade of iron, usual form, inserted into the groove of the handle of walrus ivory. The handle is in shape of an orange segment. A diminutive specimen. Blade 2$\frac{1}{16}$ inches wide.

Cat. No. 43866, U. S. N. M. Unalakleet Eskimo, Norton Sound, Alaska. Collected by E. W. Nelson.



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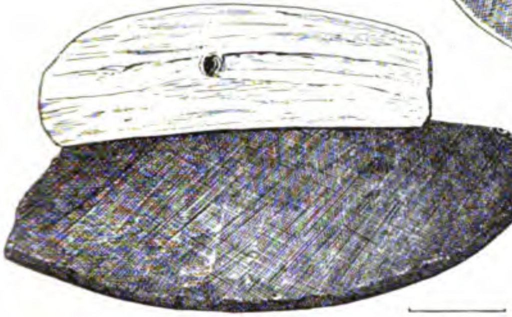

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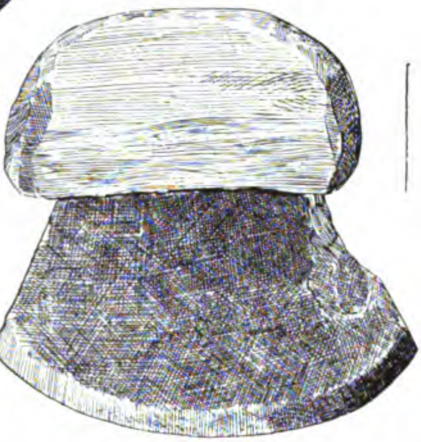

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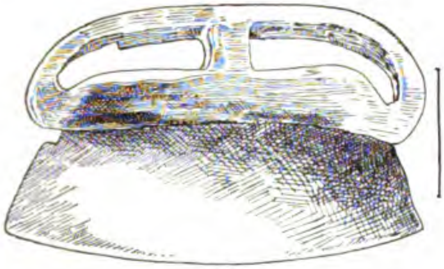

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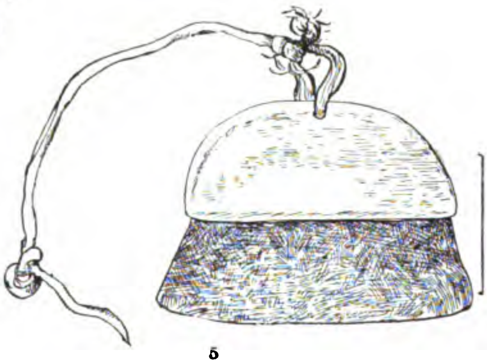

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ULUS, OR WOMAN'S KNIVES, FROM NORTON SOUND.

## EXPLANATION OF PLATE LXIV.

### ULUS, OR WOMAN'S KNIVES, FROM NORTON SOUND AND LOWER YUKON.

Fig. 1. **WOMAN'S KNIFE (ULU).** Blade of black slate, typical in form, curved edge and straight back, inserted in the groove of a clumsy pine handle, and held in place by a lashing of spruce root passing through the handle and through a hole rubbed in the blade. Length of blade, 4½ inches.

Cat. No. 38255, U. S. N. M. Ekogmut Eskimo, Lower Yukon. Collected by E. W. Nelson.

Fig. 2. **WOMAN'S KNIFE (ULU).** Blade of drab slate, long, slender, and furnished with a lashing-hole, made not by boring but by the meeting of grooves sunk on the two sides. This sort of perforation is quite common in ulu blades of slate. Length, 8 inches.

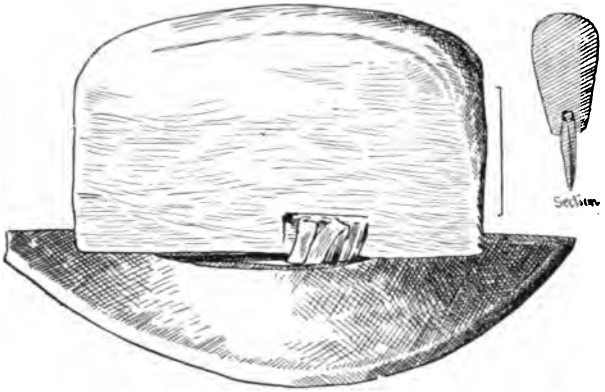
Cat. No. 48831, U. S. N. M. Ekogmut Eskimo, Lower Yukon, Alaska. Collected by E. W. Nelson.

Fig. 3. **WOMAN'S KNIFE (ULU).** Blade of dark slate, in form of circular segment. Its size indicates its use for cutting fish and meat rather than skins. Length, 10½ inches.

Cat. No. 33766, U. S. N. M. Malemut Eskimo of Norton Sound, Alaska. Collected by E. W. Nelson.

Fig. 4. **WOMAN'S KNIFE (ULU).** Called a meat-knife in Mr. Turner's catalogue. Blade of cleaver shape, riveted into a very deep groove in a handle of antler. The latter projects from the blade and has on its under side three deep finger grooves. Pierced for suspension. Length of knife, 8 inches.

Cat. No. 24365, U. S. N. M. Unaligmut Eskimo, south of Norton Sound, Alaska.



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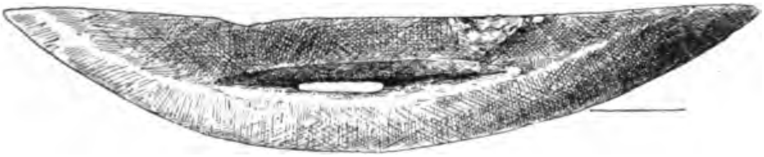

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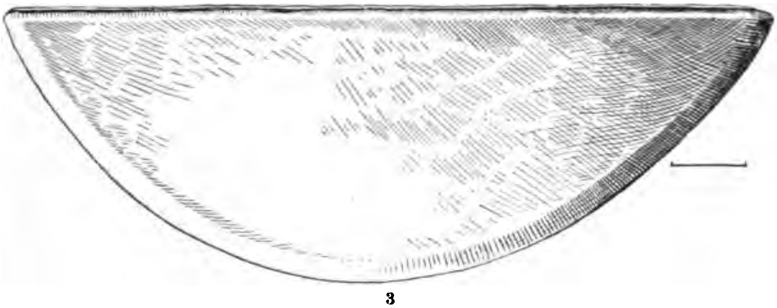

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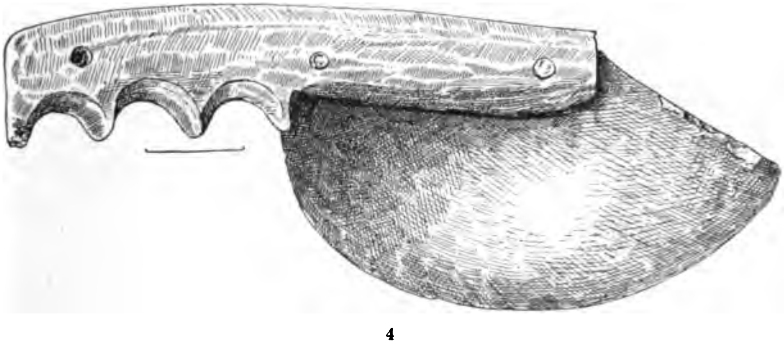

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ULUS, OR WOMAN'S KNIVES, FROM NORTON SOUND AND LOWER YUKON.

## EXPLANATION OF PLATE LXV.

### Ulus or Woman's Knives, from Norton Sound and vicinity.

Fig. 1. Woman's Knife (ulu). Blade of dark slate, shaped like a worn butcher's knife, and having a tang an inch long. Figured to show one mode of attachment. Length, 5 inches.

Cat. No. 48823, U. S. N. M. Ekogmut Eskimo, Lower Yukon, Alaska. Collected by E. W. Nelson.

Fig. 2. Woman's Knife (ulu). Handle of antler with groove cut quite through the outer and the spongy portion. Blade missing. Length, 4 inches.

Cat. No. 45489, U. S. N. M. Unaligmut Eskimo, St. Michaels, Alaska. Collected by E. W. Nelson.

Fig 3. Woman's Knife (ulu). Handle of walrus ivory, exhibiting the finest finish and the greatest economy of material. The lower portion is thickened just enough to hold the iron blade. The upper margin is expanded like the back of a razor. Doubtless the piece was made by an Eskimo, but the form and finish are quite beyond his rude tools before European contact. Length, 3 inches.

Cat. No. 48257, Eskimo of Nunivak Island, Alaska. Collected by E. W. Nelson.

Fig. 4. Woman's Knife (ulu). Handle of walrus ivory, wedge-shaped, rounded above, cut out in a crescent-shaped opening, pocket groove for blade. Length, 2⅛ inches.

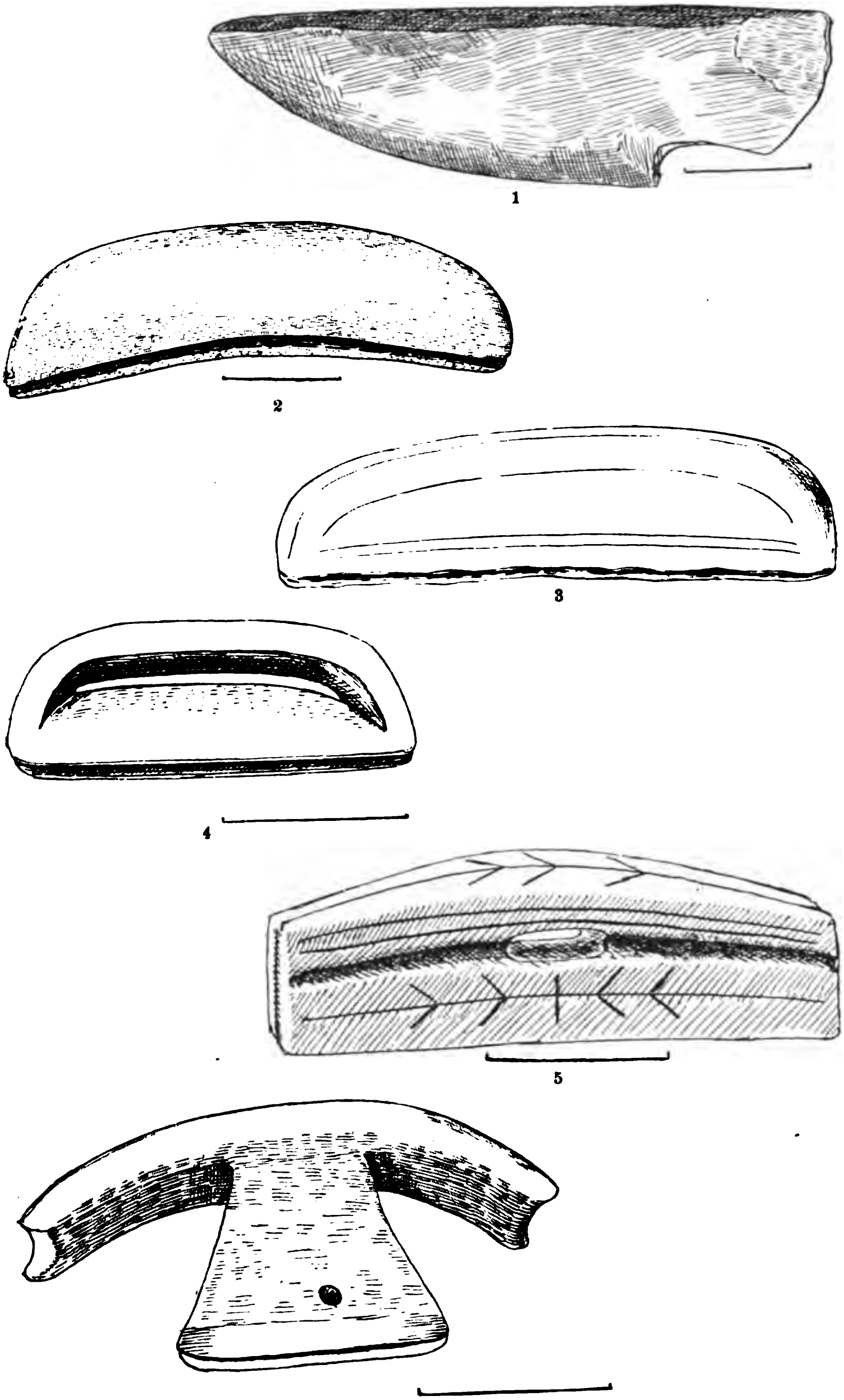
Cat. No. 43959, U. S. N. M. Eskimo north of Norton Sound, 1880. Collected by E. W. Nelson.

Fig. 5. Woman's Knife (ulu). Handle of walrus ivory, plane surface on the bottom and sides and rounded on the back. A groove extends across the middle, and at its middle the handle is perforated for a suspension cord. Length, 3 inches.

Cat. No. 37744, U. S. N. M.

Fig. 6. Woman's Knife (ulu). Handle of walrus ivory with broad stem, like Smith's Sound specimen, and grip with two wings notched at the ends. Length, 2⅞ inches.

Cat. No. 44180, U. S. N. M. Eskimo of Cape Darby, Alaska, 1880. Collected by E. W. Nelson.



ULUS, OR WOMAN'S KNIVES, FROM NORTON SOUND AND VICINITY.

## EXPLANATION OF PLATE LXVI.

### ULUS, OR WOMAN'S KNIVES, FROM NORTON SOUND TO KUSKOKVIM RIVER.

Fig. 1. **WOMAN'S KNIFE (ULU).** Handle of walrus ivory, with slit for insertion of metal blade, without rivets. There is an opening to form the grip, and a projection at one end is in imitation of a seal's head. The ornamentation consists of scratches and a coarsely cut gutter. Blade wanting. Length, 3½ inches.

Cat. No. 38366, U. S. N. M. Nuloktologamut Eskimo, Alaska. Collected by E. W. Nelson.

Fig. 2. **WOMAN'S KNIFE (ULU).** Handle of walrus ivory, with slit for insertion of metal blade, without rivets. The grip is cleverly formed by the elongated body of marmot, the head projecting. Ornamentation, three bands scratched on the border and five dots. Blade wanting. Length 4¼ inches.

Cat. No. 38129, U. S. N. M. Nuloktologamut Eskimo, Alaska. Collected by E. W. Nelson.

Fig. 3. **WOMAN'S KNIFE (ULU).** Handle a delicate specimen of walrus ivory in form of a sledge, the groove for the metal blade in the curved portion. The grip separated from the blade piece by a long open space. At the end of the handle is the head of a seal devouring a miniature walrus. The dot and circle ornament is used. Length, 4¾ inches.

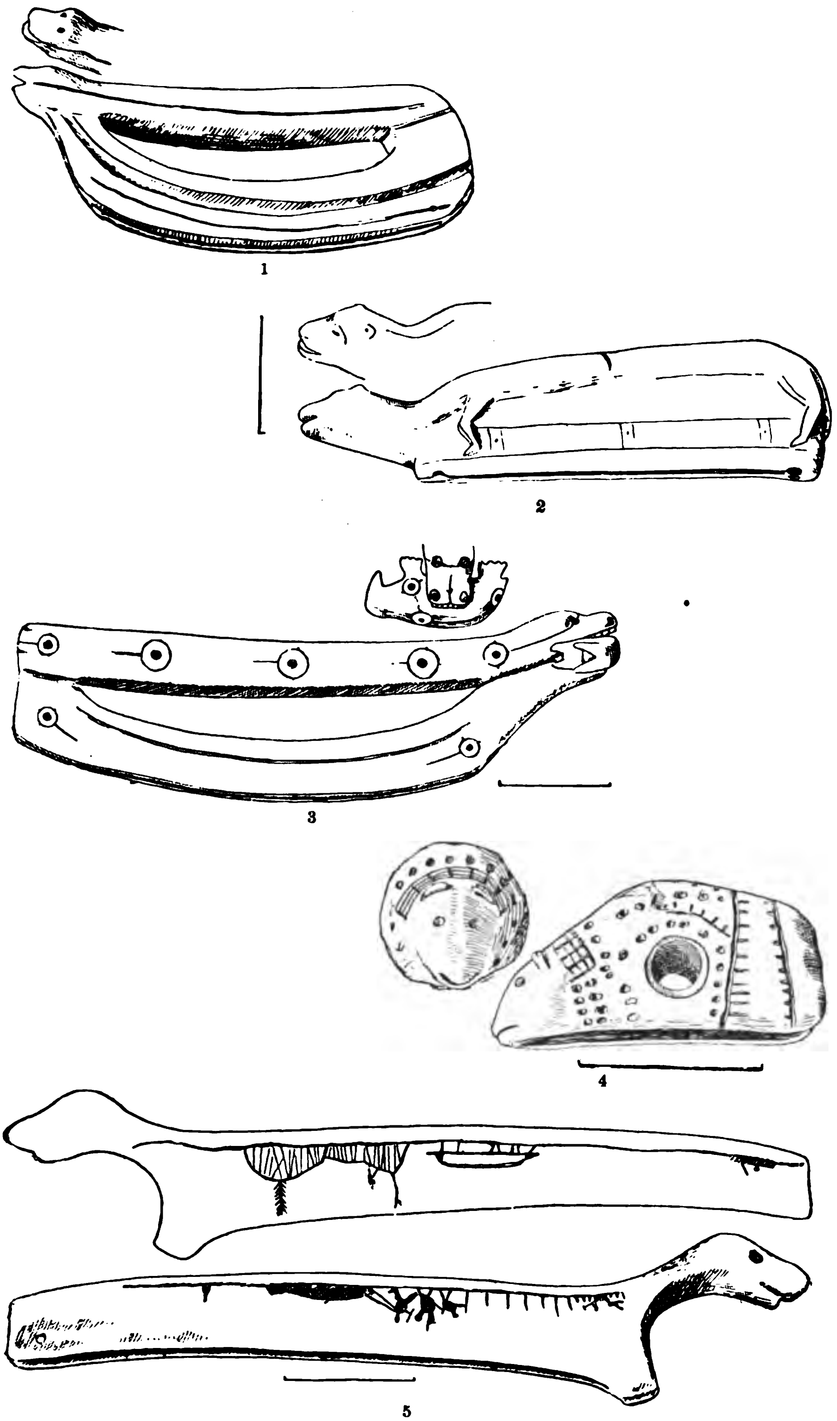
Cat. No. 37960, U. S. N. M. Magemut Eskimo of Kuskokvim Bay, Alaska Collected by E. W. Nelson.

Fig. 4. **WOMAN'S KNIFE (ULU).** Small handle of walrus ivory, fairly carved, and having a deep groove for a metal blade. On one end is the head of some animal, on the other a human face, and all over the surface dots and geometric patterns. Length, 1¾ inches.

Cat. No 33628, Unaligmut Eskimo, St. Michaels, Alaska. Collected by E. W. Nelson.

Fig. 5. **WOMAN'S KNIFE (ULU).** Handle of antler, and unique in form. In addition to the usual groove for the blade, the handle is extended in one direction to form the head of an animal. Upon the sides are shown the igloo, or hut, of an Eskimo family, the scaffold, on which all things are put out of the way of the dogs, and a party of Eskimo. Length, 6 inches.

Cat. No. 24376, U. S. N. M. • Eskimo of Norton Sound. Collected by Lucien M. Turner.



ULUS, OR WOMAN'S KNIVES, FROM NORTON SOUND TO KUSKOKVIM RIVER.

## EXPLANATION OF PLATE LXVII.

### ULUS, OR WOMAN'S KNIVES, FROM KUSKOKVIM DISTRICT.

Fig. 1. WOMAN'S KNIFE (ULU). Handle of walrus ivory, with slit for insertion of metal blade, without rivets. The outer margin is enlarged to form a secure grip. The ornamentation by concentric rings variegated with grooved lines has a pleasing effect. Blade wanting. Length of handle, 3¼ inches.

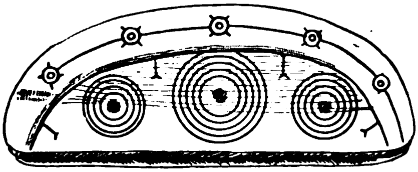
Cat. No. 37827, U. S. N. M. Agaiagamute Eskimo, Alaska. Collected by E. W. Nelson.

Fig. 2. WOMAN'S KNIFE (ULU). Blade of iron, set in the groove of a walrus ivory handle. With endless variety of detail this form of handle, with a crescent-shaped opening, is typical. Ornamentation, a groove above with cross lines in pairs and fours and cross hatching in the lower part. Width of blade, 3 inches.

Cat. No. 3 316, U. S. N. M. Kongiganagamute Eskimo, north shore of Kuskokvim Bay, 1879. Collected by E. W. Nelson.

Fig. 3. WOMAN'S KNIFE (ULU). Handle of walrus ivory, very gracefully carved and ornamented with thickened base for blade, a crescent-shaped razor-back on the upper margin, a very thin diaphragm between the base and upper border, which is cut away on its upper margin. The blade is of iron, and the whole piece is very beautiful. Length, 3⅜ inches.

Cat. No. 130617, U. S. N. M. Eskimo of Kuskokvim River, Alaska. Collected by Cyrus Adler.



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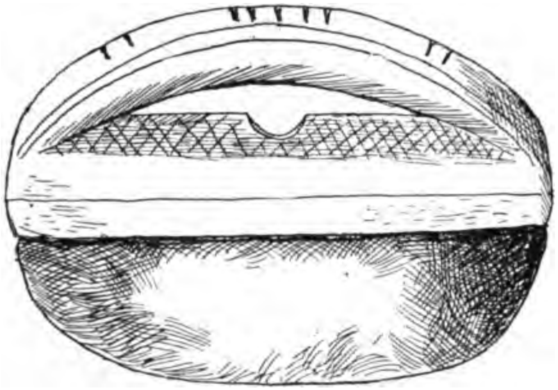

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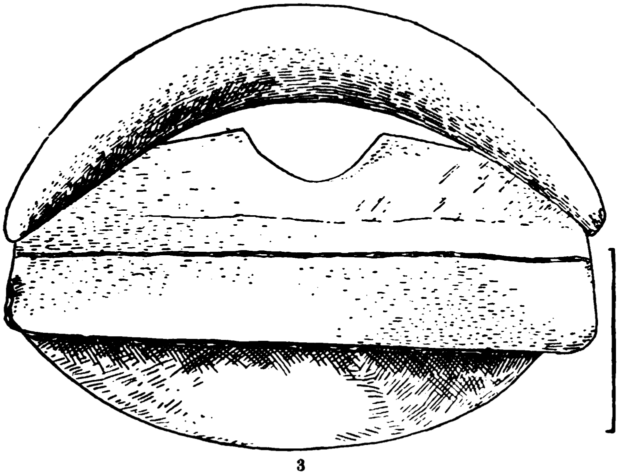

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ULUS, OR WOMAN'S KNIVES, FROM KUSKOKVIM DISTRICT.

## EXPLANATION OF PLATE LXVIII.

### ULUS, OR WOMAN'S KNIVES, FROM BRISTOL BAY.

Fig. 1. **WOMAN'S KNIFE** (ULU). It is simply a blade or celt of slate, with a handle of wood pierced and fitted on the top so that the slate extends through and above. It is evident that we have here gotten below the walrus area and the region of stone with conchoidal fracture. It is also evident that we are away from the lines of Aboriginal and European travel and traffic. Length of handle, 2¾ inches.

Cat. No. 127389, U. S. N. M. Eskimo of Ugashik, Bristol Bay, Alaska. Collected by I. Applegate.

Fig. 2. **WOMAN'S KNIFE** (ULU). Handle of wood. Blade of slate, resembling a short jackknife, blade inserted into the end of the triangular handle and lashed with sinew. Length, 5 inches.

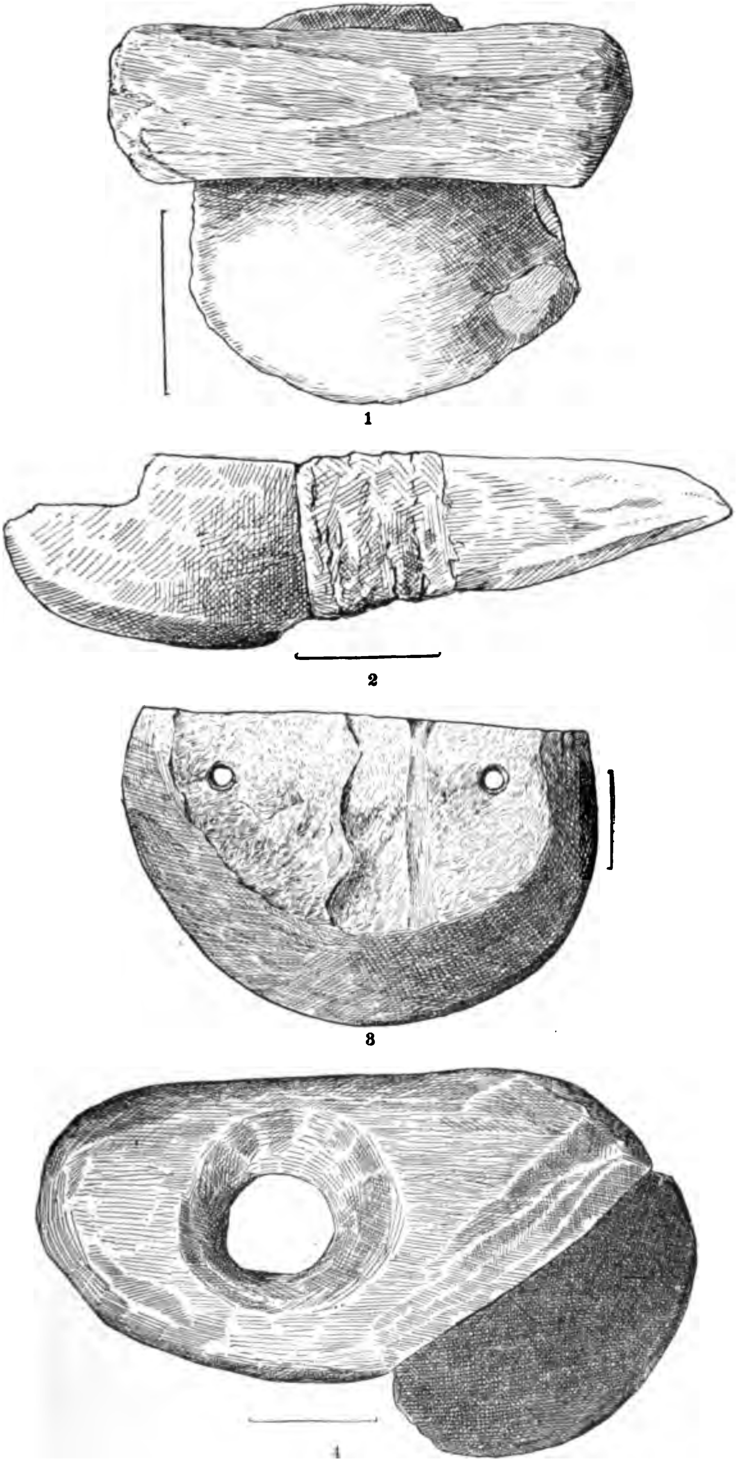
Cat. No. 127735, U. S. N. M. Ogulmut Eskimo of Ugashik, Alaskan Peninsula. Collected by W. J. Fisher.

Fig. 3. **WOMAN'S KNIFE** (ULU). Blade of greenish slate, semicircular, pierced twice near the upper margin for lashing or for rivets. Width, 5 inches.

Cat. No. 90409, U. S. N. M. Ogulmut Eskimo of Bristol Bay, Alaska. Collected by W. J. Fisher.

Fig. 4. **WOMAN'S KNIFE** (ULU). Blade of slate, leaf-shaped, inserted in the end of the odd-shaped wooden handle at an angle of 45°. The handle is perforated for the thumb and fingers, and for suspension. Length of handle, 5 inches.

Cat. No. 12738 , U. S. N. M. Eskimo of Togiak River. Collected by I. Applegate.



ULUS, OR WOMAN'S KNIVES, FROM BRISTOL BAY.

## EXPLANATION OF PLATE LXIX.

### ULUS, OR WOMAN'S KNIVES, FROM BRISTOL BAY.

Fig. 1. **WOMAN'S KNIFE** (ULU). Blade of iron, in shape of a sledge runner, inserted in a pocket groove of the ivory handle, which has the shape of the Egyptian symbol of the eye. Length, 3¾ inches.

Cat. No. 55918*a*, U. S. N. M. Eskimo of Bristol Bay, Alaska. Collected by C. L. McKay.

Fig. 2. **WOMAN'S KNIFE** (ULU). Blade of slate, inserted in a pocket groove of the wooden handle. The latter is shaped like the Egyptian symbol for the eye, the opening forming a convenient cavity for thumb and middle finger. Compare 55918. Length, 5½ inches.

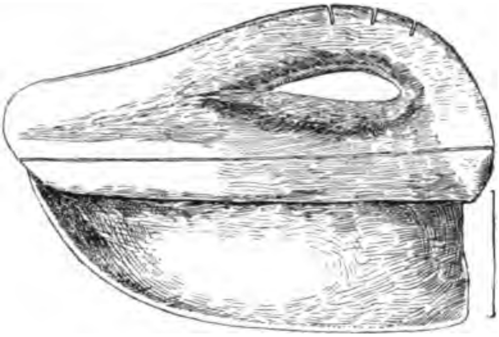
Cat. No. 55916*a*, U. S. N. M. Eskimo of Bristol Bay, Alaska. Collected by C. L. McKay.

Fig. 3. **WOMAN'S KNIFE** (ULU). Blade of iron, rounded at either end, inserted in a pocket groove of the ivory handle, which has a notched back and unsymmetrical opening for the thumb and fingers. Length, 4½ inches.

Cat. No. 55918, U. S. N. M. Eskimo of Bristol Bay, Alaska. Collected by C. L. McKay.

Fig. 4. **WOMAN'S KNIFE** (ULU). Blade and handle of one piece of iron, the former in shape of a butcher's knife, the latter is curled over the blade in a sigmoid curve and slightly welded to the back. Evidently not of native make. Length, 6½ inches.

Cat. No. 55918*b*, U. S. N. M. Eskimo of Bristol Bay, Alaska. Collected by C. L. McKay.



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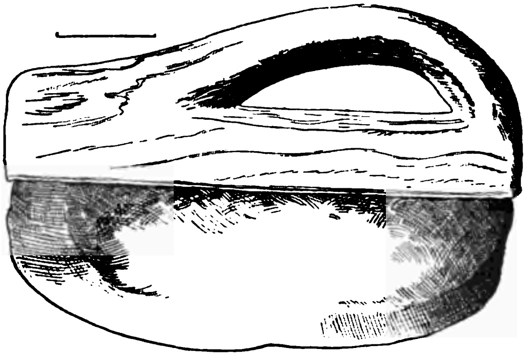

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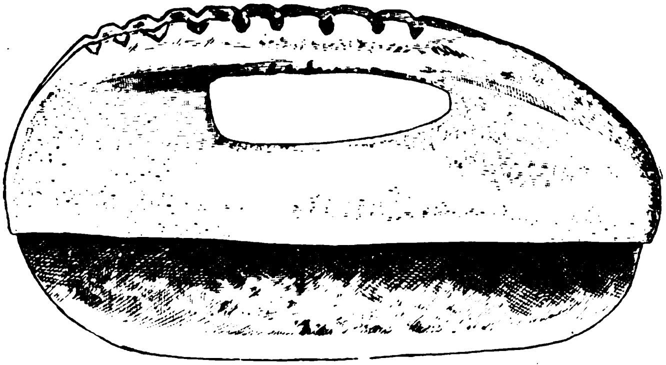

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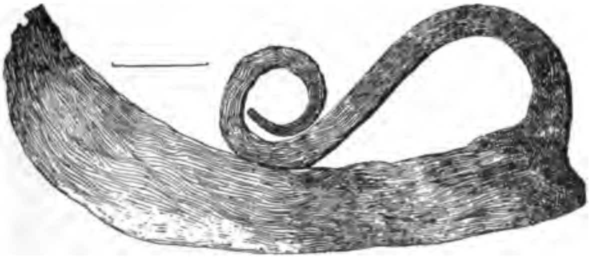

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ULUS, OR WOMAN'S KNIVES, FROM BRISTOL BAY.

## EXPLANATION OF PLATE LXX.

### ULUS, OR WOMAN'S KNIVES, FROM BRISTOL BAY, ALASKAN PENINSULA, AND KADIAK.

Fig. 1. WOMAN'S KNIFE (ULU). Blade of fine black slate, set in a deep pocket groove of the wooden handle. Space cut out on both sides of the handle for thumb and middle finger. Length, 3½ inches.

Cat. No. 55916*b*, U. S. N. M. Eskimo of Bristol Bay, Alaska. Collected by C. L. McKay.

Fig. 2. WOMAN'S KNIFE (ULU). Blade of slate, set in a pocket groove in a handle of cedar wood, and held in place by a seizing of wood. A very old and much used specimen. Length, 7¾ inches,

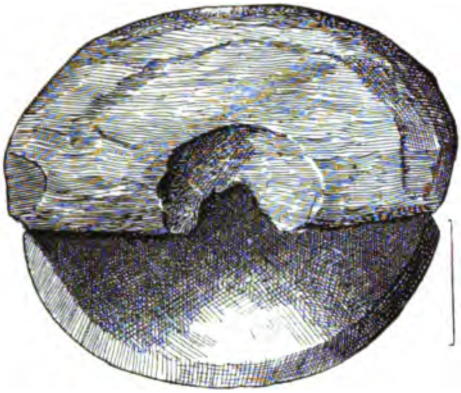
Cat. No. 90410, U. S. N. M. Eskimo of Kadiak Island, Alaska. Collected by W. J. Fisher.

Fig. 3. WOMAN'S KNIFE (ULU). Blade of slate, shaped like a sledge runner, lashed to a handle of wood, which is much too short, by a splint of root passing through the blade and over the handle. Width of blade, 6¾ inches.

Cat. No. 90412, U. S. N. M. Eskimo of Kadiak Island, Alaska. Collected by W. J. Fisher.

Fig. 4. WOMAN'S KNIFE (ULU). Blade of slate, set in a pocket groove of the handle, made by splitting the latter, excavating the groove and then lashing the two parts together and to the blade by sinew passing through the blade and through the handle and sunk in a groove of the handle on either side. The handle has spindle-shaped ends. Length, 9½ inches.

Cat. No. 72541, U. S. N. M. Eskimo of the Alaskan Peninsula. Collected by W. J. Fisher.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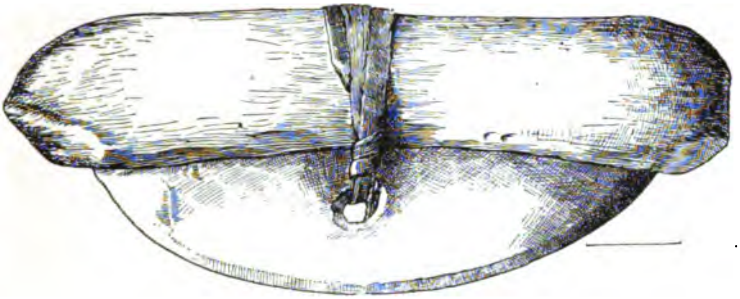
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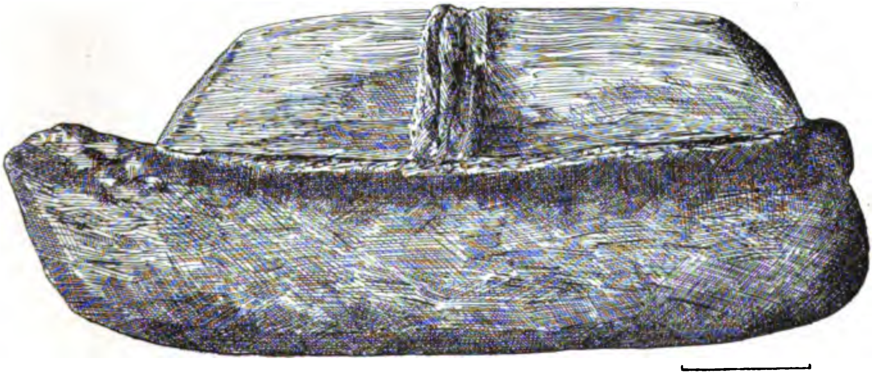
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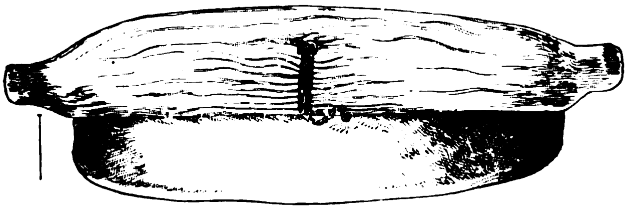
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ULUS, OR WOMAN'S KNIVES, FROM BRISTOL BAY, ALASKAN PENINSULA, AND KADIAK.

## EXPLANATION OF PLATE LXXI.

### ULUS, OR WOMAN'S KNIVES, FROM KADIAK AND SOUTHWARD.

Fig. 1. WOMAN'S KNIFE (ULU). Large blade of slate inserted in a groove of the cylindrical handle of wood, and held in place by a lashing of braided sinew, which for some unknown reason is stretched beneath the handle from one lashing to the other. Length of blade, 5⅝ inches.

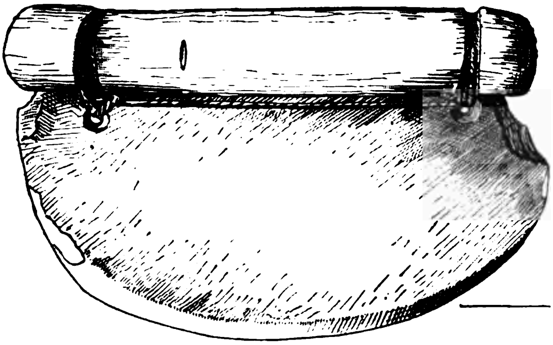
Cat. No. 72540, U. S. N. M. Eskimo, Kadiak. Collected by W. J. Fisher.

Fig. 2. WOMAN'S KNIFE (ULU). Blade of iron, crescent-shape, and handle of wood, the whole closely imitating those in use among civilized people for meat choppers. Length of handle, 6¼ inches.

Cat. No. 74362, U. S. N. M. Tlingit Indians, Sitka, Alaska. Collected by T. T. McLean.

Fig. 3. WOMAN'S KNIFE (ULU). Blade of slate. Handle wanting. Upon the upper margin of the blade is a tang 1⅝ inches wide to render it firm in its handle. Width of blade, 6¼ inches.

Cat. No. 127726, U. S. N. M. Tlingit Indians of Fort Wrangle, Alaska. Collected by W. J. Fisher.



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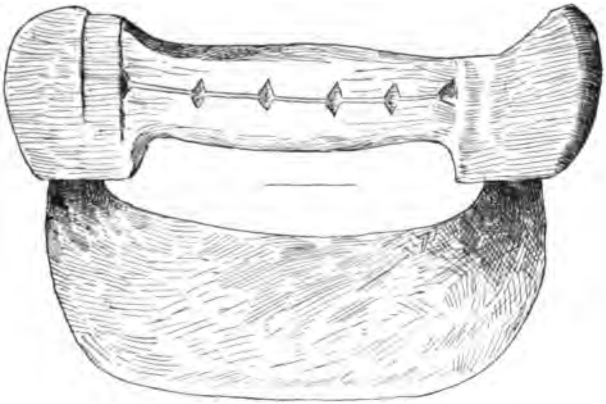

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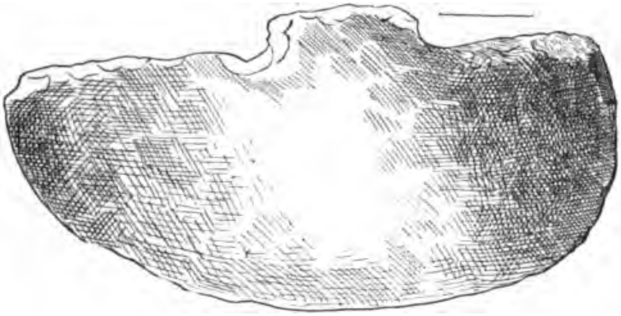

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ULUS, OR WOMAN'S KNIVES, FROM KADIAK AND SOUTHWARD.

## EXPLANATION OF PLATE LXXII.

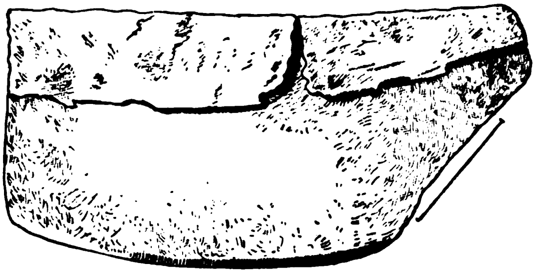
### ULUS, OR WOMAN'S KNIVES, FROM HAIDA INDIANS.

Fig. 1. WOMAN'S KNIFE (ULU). Blade made of a thin strip of sheet iron, with a bent strip of copper, forming a strengthening to the back. Length, 2¼ inches.

Cat. No. 20840. Kootznoo Indians (Kolushan stock).

Fig. 2. WOMAN'S KNIFE (ULU). Blade of iron, inserted in a handle formed by bending a strip of sheet copper extending half an inch down on either side. Length of blade, 5¾ inches.

Cat. No. 88771, U. S. N. M. Haida Indians of Queen Charlotte Archipelago. Collected by James G. Swan.



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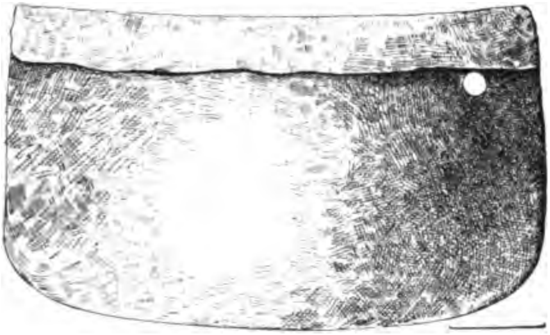

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ULUS, OR WOMAN'S KNIVES, FROM HAIDA INDIANS.

# THE ANCIENT PIT-DWELLERS OF YEZO.

By ROMYN HITCHCOCK.

When the first Emperor of Japan, known by the posthumos title Jimmu Tenno, whose traditional reign began 660 B. C., was on his imperial journey eastward from ancient Tsukushi, to establish the seat of government in Yamato, he came to a great "cave" or "apartment", in which eighty *tsuchi-gumo* or cave-dwelling savages were awaiting him. The word *tsuchi-gumo* is usually translated "earth-spiders," but Prof. B. H. Chamberlain regards it as a corruption of *tsuchi-gomori*, or "earth-hiders." Whatever the original meaning may have been, there can be no doubt that it was applied to a savage people, who inhabited Japan before the coming of the Japanese.

The ancient records of the Japanese contain many allusions to these dwellers in caves, or dwellers under ground. In the reign of the Emperor Keiko two Kumaso braves were killed in a cave by Yamato-take. The Empress Jingo Kogo was wrecked among *tsuchi-gumo*. They are said to have been numerous in Bungo and in other western provinces, in Omi, in Yamato, and in other localities.

The character of their dwellings is not clearly defined, owing to the ambiguous meaning of the Chinese character translated "cave." In certain parts of Japan natural caves are numerous, but they are not common throughout the country. Artificial caves are not uncommon, but I have endeavored to show, in an article treating of ancient Japanese burial customs, read before section H of the American Association for the Advancement of Science at Toronto in 1889, that such caves were constructed for interment of the dead and not for dwellings. Still other structures, chambers made by piling up huge rocks and heaping up mounds of earth to cover them, are also numerous in southern Japan, and these have been designated as caves by von Siebold, rather carelessly it seems to me. But these also were only burial chambers. Granting that mere opinions concerning such a subject are not of much value, I would only add that until some stronger evidence than von Siebold has adduced gives color to the idea that the early inhabitants of Japan lived in true caves, I hold that their dwellings were more probably of the character of the pit-dwellings to be described in this article. It is true we do not find the ruins of such dwellings in the south, although they are numerous in Yezo. This is doubtless because all such ruins have been destroyed in the more populous island, where every available plot of ground has long been under cultivation.

The fact is not to be overlooked, however, that the idea of cave life was familiar to the ancient Japanese. The well-known myth of the sun-goddess, who retired into a cave and closed the entrance with a stone, is significant of the truth of this assumption. It is not unlikely that the idea came from China and that true cave life was never practiced in Japan.

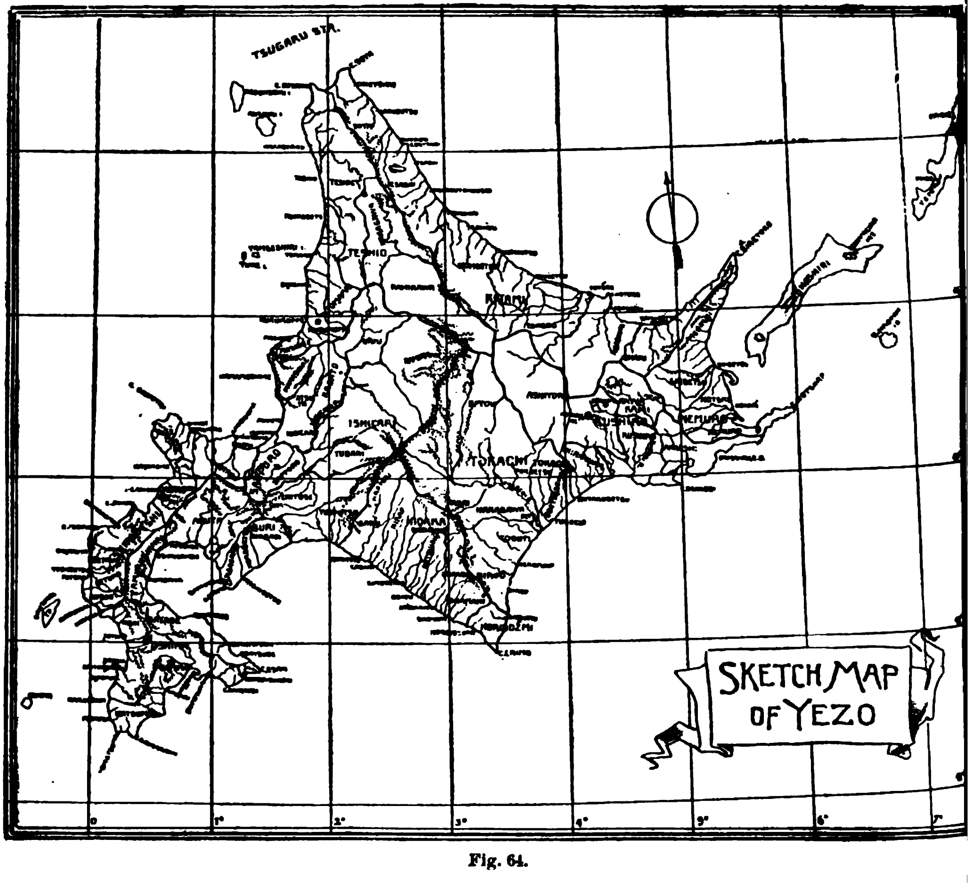


Fig. 64.

There are still other people mentioned in the Japanese records, distinguished as Ebisu or hairy savages, who were contemporaneous with the earth-hiders. It is not difficult to recognize in these the ancestors of the Ainos, who are now confined to Yezo. Not only is the historic evidence clear that the Ainos once lived in the main island as far south as Sendai, but we have numerous facts in support of the further conclusion that, in more ancient times, they occupied the coast as far south as the extreme end of Kiushiu. Such evidence we find in the distribution of geographical place-names, which are obviously of Aino origin, in the names of famous characters in Japanese mythology, which are certainly of Aino derivation, and in the contents of kitchen-middens or shell-heaps, which are numerous here and there along the coast.

The writer has briefly summarized the evidence of Aino occupancy of Japan in the paper following this one. The character of the pottery found in the shell-heaps is entirely different from any pottery made by the ancient Japanese. The material is the same as that of the Japanese sepulchral pottery, but the shapes of the vessels are not the same and the decoration upon them is absolutely distinctive. Strange as it may seem, the pottery of the shell-heaps is far more elaborately decorated than any ancient pottery of Japanese origin.

Plate LXXIII shows a number of specimens from the large collection of M. l'Abbe Furet, of Hakodate, which I was very kindly permitted to photograph. Many of these are covered with complex designs, such as are absolutely unknown on Japanese pottery. The small fragments representing parts of human figures are, so far as I am aware, unique. Owing to the absence from home of the collector, I was unable to learn anything about them.

The ancient Japanese pottery comes from burial mounds which are prehistoric, or at least which date from a time before the year A. D. 400, when the authentic records of Japan begin. The pottery of the shell-heaps, often designated as Aino pottery, although more elaborately decorated, must be older than this, and it would seem to afford indisputable evidence that the Japanese were preceded by an aboriginal people, who were potters. We find the same kind of pottery in Yezo, in the shell-heaps at Otaru, near Sapporo, on the small island Benten-jima, in Nemuro harbor, about ancient pits in Kushiro, and about similar places on the Island of Yeterof. Associated with it everywhere are found arrow-heads and other implements, such as may be found scattered over many parts of Yezo in the surface mold at the present day.

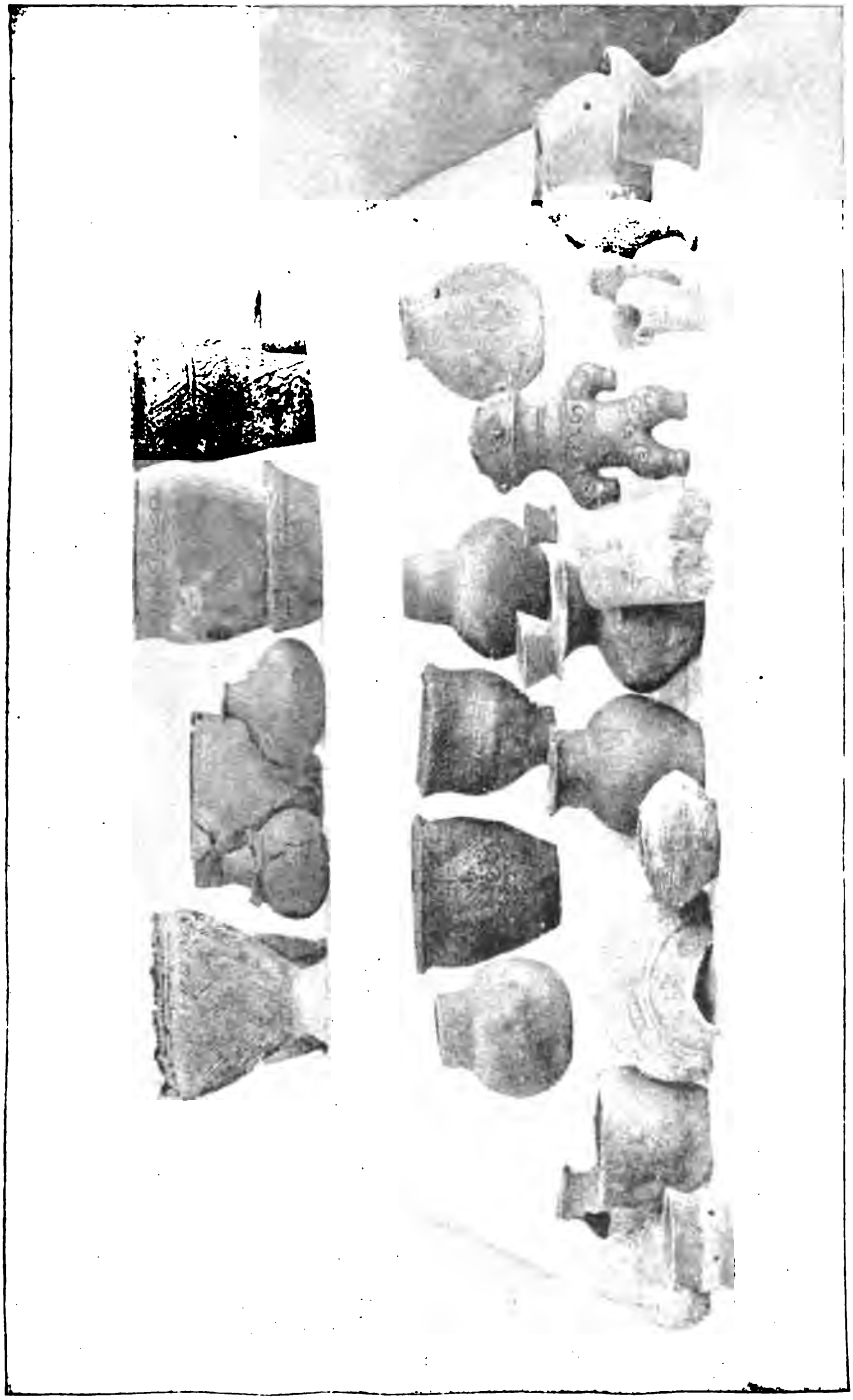
The question then arises, to what people shall we attribute this spoil? It has been supposed that the shell mounds were left by the Ainos. This is the opinion of Prof. John Milne. But we immediately come face to face with the fact that the Ainos of the present day do not make pottery. The claim is made, upon rather insufficient ground it seems to me, that the Ainos formerly did make pots; but if so, it is strange that in all my journeying among them I found no indications of such handiwork, nor of their need of such utensils. I can not bring myself to believe that a people who not only possessed that useful art, but who also acquired such a degree of artistic skill in decorating their productions, could have absolutely lost it. Certainly it could not have disappeared within a century, as we must suppose if we accept all the evidence we possess of Aino pot making.

It would be a bold assumption indeed to suppose that the dwellers in earth houses, the *tsuchi-gumo*, made the pottery. We have no evidence of this further than the fact that here and there fragments of pottery, and occasionally well-preserved vessels, are found about pits in Yezo and Yeterof, which, as I shall endeavor to show, are probably the ruins of a kind of pit-dwellings corresponding, in the opinion of the present writer, to those of the traditional *tsuchi-gumo*. The pottery is there, and it assuredly was not made by the Japanese. It may be much older than we think, older than the Aino occupancy; older than even the traditions of the Japanese. Whoever were the people who made it, they spread over the whole country from southern Kiushiu to the bleak shores of Yezo and the adjacent islands.

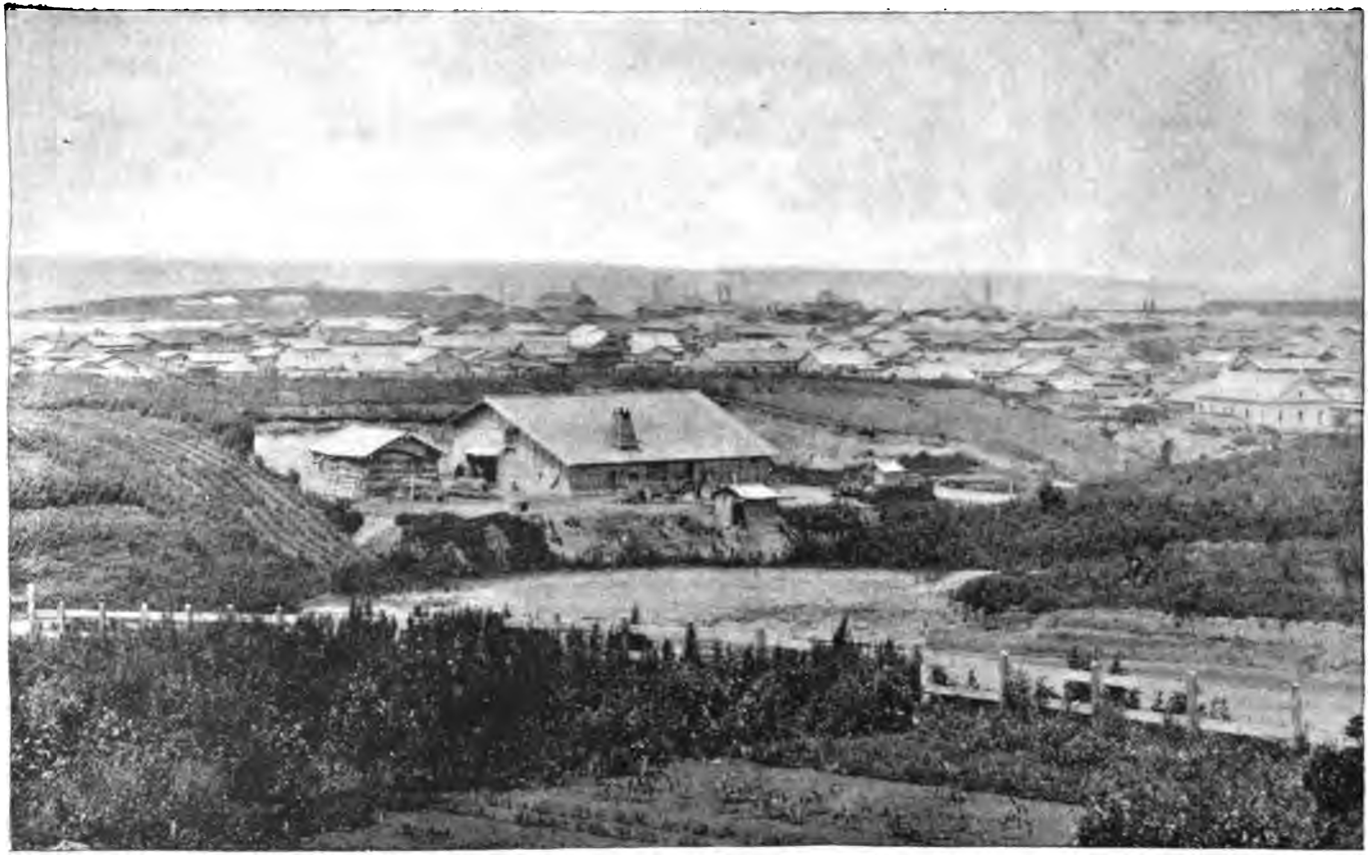
Who were the pit-dwellers of Yezo? I have supposed them to be the *tsuchi-gumo* of tradition, but our only knowledge concerning these is found in the Japanese accounts, unreliable enough, but at the same time not without some bearing on the question. For one would scarcely expect such circumstantial and numerous accounts of meetings and combats with dwellers in burrows or caves to be pure inventions. The word "cave" translated means "apartment." They were not cave-dwellers in the ordinary sense, for in nearly all the accounts of the people they seem to have lived in holes dug in the ground. We have the less reason to doubt this, since it is known that the Smelenkur of Saghalin construct earth-covered dwellings on the sides of hills, not in any sense caves, and houses of another form will shortly be described which may, with still more probability, represent the dwellings of the *tsuchi-gumo*.

Mr. T. W. Blakiston first brought prominently into notice certain remarkable depressions or pits in the ground which he had observed in various parts of Yezo, and which he believed to be the remains of human habitations. In the summer of 1888 I made an extended journey in the island, covering a distance of more than 800 miles on horseback, visiting the Ainos and always looking for pits. The pits are numerous in places, usually on elevated land near the coast, or overlooking the mouths of rivers, presumably that the people might readily sight shoals of fish. The island known as Bentenjima, which forms a breakwater to Nemuro harbor, is covered with numerous pits. Plate LXXIV shows the town as seen from the residence of Mrs. H. Carpenter, a most devoted missionary, and the only foreign resident. The island is seen on the left. Just back of the three sheds or storehouses bordering on the water, where the bank is falling away, there is a small line of white, indicating the remains of a shell-mound. It was at this spot that Prof. John Milne, in 1881, found some fragments of pottery, several arrow-heads, and one complete vase. I was only able to find a few broken shells, not having the means with me for digging.

About 4 miles from Nemuro, in a northeasterly direction, on a bluff overlooking the sea, near the mouth of a small stream, there are seven pits, approximately square in shape, varying in length from 10 to 20



Ancient Pottery from M. l'Abbé Furet Collection.



VIEW OF NEMURO AND BENTENJIMA.

feet. They are not well preserved, but it was thought worth while to dig a trench across one of them in the hope of finding some pottery or arrow-heads. The trench was dug two feet wide down to a stratum of clay, but nothing was found.

On the island of Yeterof there are many hundred of such pits on elevated knolls some distance from the coast, but overlooking a broad valley, through which a stream meanders for a long distance nearly parallel to the coast. It seemed to me quite possible that at the time the dwellings represented by these pits were inhabited, the present river valley was an immense arm of the sea, and a rich fishing-ground. It was about these pits that Mr. Blakiston says fragments of pottery were picked up. I was therefore quite anxious to explore one of them with a spade, and leaving my companions, Mr. Leroux and Mr. Odlum, I set off in search for a habitation. After a long walk I found an Aino hut occupied by an old woman, and there obtained a dilapidated old Japanese instrument which was used for digging. It was the best the country afforded, so I carried it back and we dug over the whole bottom of the pit, and also in several places outside, without finding a single article to reward us. We made some measurements of the pits in the vicinity, which were large and well preserved. Two pits gave the following results:

| Southeast and northwest. | Northeast and southwest. | Depth. |
|---|---|---|
| *Metres.* | *Metres.* | *Centimetres.* |
| 4 | 3.8 | 53 |
| 4 | 4.5 | 73 |

Although I have not yet found a single piece of pottery, nor a chipped flint in any pit where I have dug, it does not follow that nothing of the kind is to be found about them. Other explorers have been more fortunate. The most promising locality for such explorations is at Kushiro, on the southeast coast of Yezo. Only want of the necessary time prevented me from digging about the pits there. In walking over the ground I picked up several small bits of old pottery which the rains had washed out, and the Japanese local officers showed me a small collection of vessels, tolerably well preserved, which had been found there. Some of the Kushiro pits are very large. I measured one, which was 32 feet across and 8 feet deep.

The Ainos have a tradition concerning a race of dwellers under ground called *koro-pok-guru*, who formerly occupied the country. The Ainos claim to have subdued and exterminated them. We have no means of knowing whether this is a genuine tradition, or a late invention to explain the existence of the pits. Presuming it to be the former, it is not unreasonable to suppose that the Aino account of dwarfs, who lived under ground, and the Japanese tales of earth-spiders or *tsuchi-gumo*, refers to the same people. In the light of the observations related further on, it would also seem probable that the pits of Yezo are the ruins of the dwellings once occupied by them, now affording landmarks whereby we may trace the migrations of a once numerous people to their disappearance and oblivion.

In the year 1878 Prof. John Milne* visited Shumushu or Peroi Island, the most northern of the Kuriles. There, at the village of Myrup, he found a small colony of migratory people who made huts over excavations. His account of them is short. He writes:

> Here there were three wooden houses which had been built by the Russians, and quite a number (perhaps a score) of half underground dwellings. On landing we found that all these were deserted, and in many cases even difficult to find, owing to the growth of wormwood and wild grasses.
>
> The inhabitants of the island, who call themselves Kurilsky, are twenty-three in in number. They chiefly live at a place called Seleno, about 4 miles distant. I mention these people, as they seem to be the only inhabitants of the Kuriles north of Iturup (Yeterof).

It appears that the dwellers in the deserted houses were migratory. Professor Milne has elsewhere declared that "these excavations have a striking resemblance to the pits which we find further south."

A Japanese author, Mr. Y. Hashiba, has published a description of some peculiar dwellings built over pits, which he found in Shonai, on the west coast of the northern part of the main island of Japan. I am indebted to Mr. P. Jaisohn for a partial translation of this article, which is written in Japanese. There are two huts, built over circular pits about 1 foot in depth by 2 to 3 yards in diameter. The framework of one is of reeds, that of the other of branches, over which there is a covering of earth 2 feet thick. In the middle of the floor is a triangular fireplace. Other pits were found in the vicinity and fragments of pottery, but the pottery is said to differ from that found in Yezo. The points of difference I have been unable to learn.

The Aleuts build also over excavations in the earth, erecting a framework of wood over which they pile a covering of sods. The entrance to such dwellings is through a low passage along which one must crawl.

When the Japanese obtained the Kurile Islands from Russia in exchange for Saghalin, they determined to transfer the few inhabitants they found there to a more accessible spot. They selected the island of Shikotan, and although the people did not wish to change their abode, a steamer was sent to take them away, and thus a colony of about one hundred persons was established on Shikotan. This island is situated nearly east of the extreme eastern limit of Yezo and south of Kunashiri. It is small, mountainous, not of much importance, and difficult to reach.

Professor Milne was the first to tell me of these people, but he had not seen them. At Nemuro I made inquiries about them and resolved

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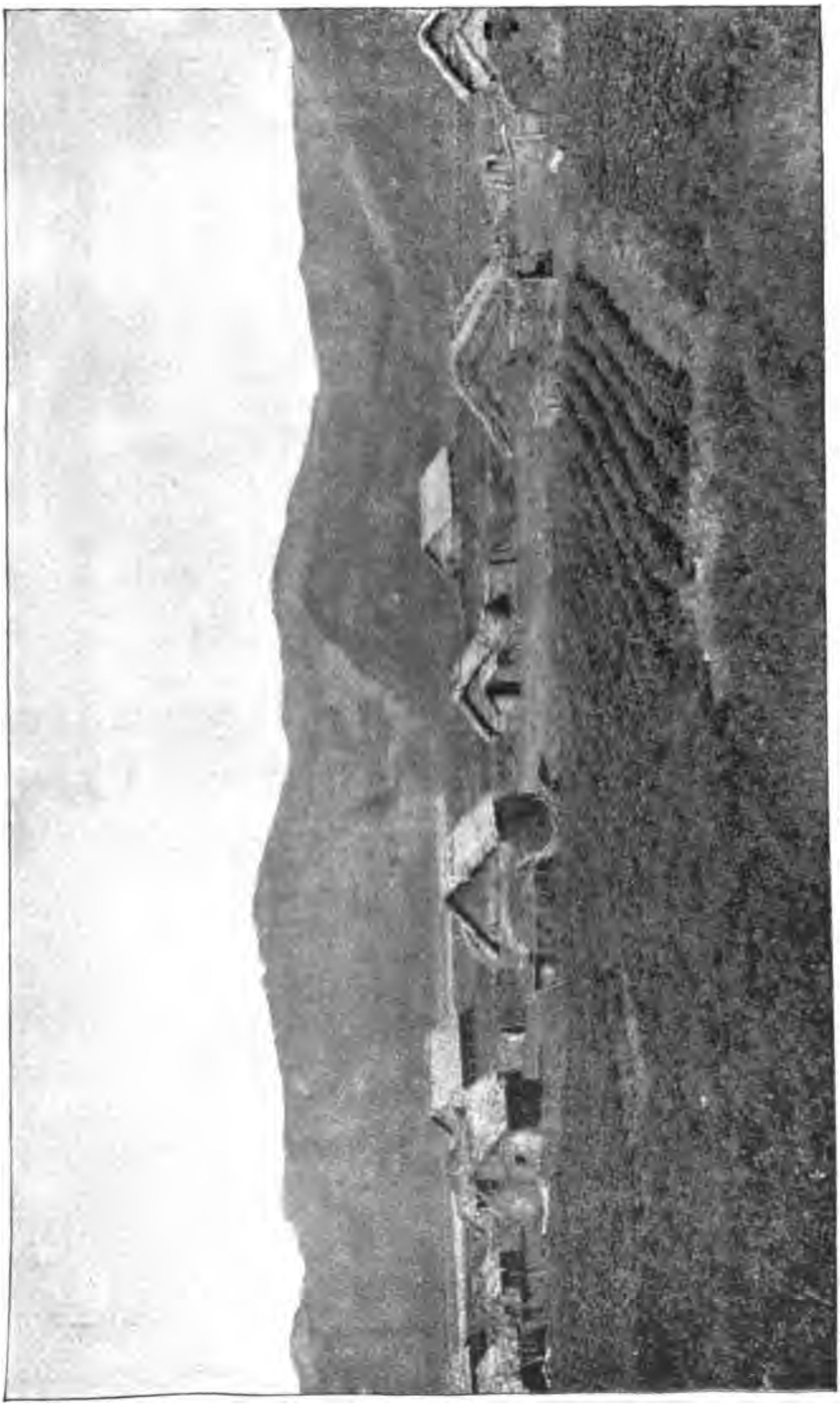
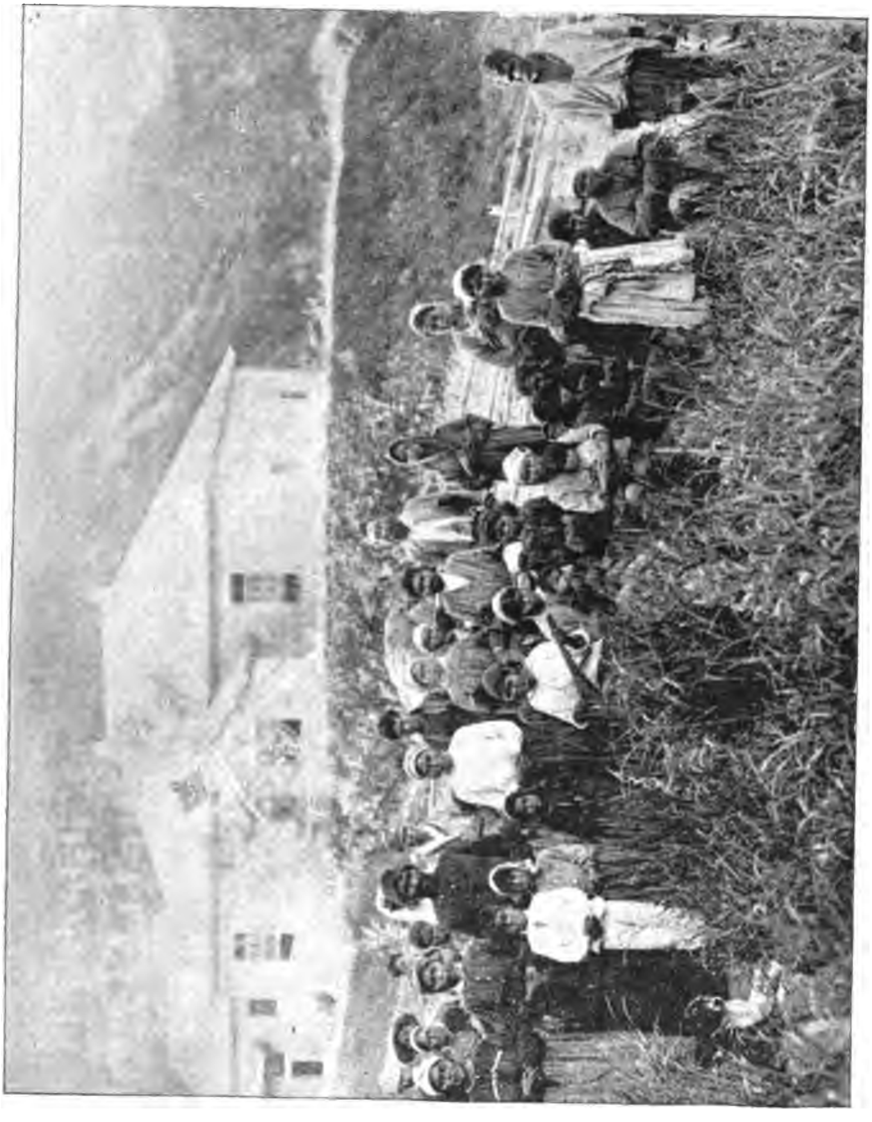
*Trans. Seismological Soc. of Japan, IX, 1886, pp. 127, 128.



VILLAGE OF SHIKOTAN, GENERAL VIEW.



VILLAGERS (KURILE ISLANDERS), SHIKOTAN.

to visit them if possible. My Japanese servant bargained for a native fishing-boat to carry me over, and the lowest price offered was $30 for the trip. In such a craft the trip would not be without danger, and it might be a voyage of either a day or a week. Fortunately I had already made the acquaintance of two other foreigners who were traveling for pleasure and observation, and as we happened to be together in Nemuro, they had become interested in my proposed visit to Shikotan. But the fishing-boat plan did not seem to be well received by either of them. M. Lereux, chef de musique at Tokio, one day hailed me on the street with the news that in four days a steamer was going to Yeterof and would stop for us at Shikotan. Mr. Odlum, a botanist, joined us, and at 3:45 a. m., on August 9, the Yoshinomaru with her three foreign passengers and a load of salt for the fisheries of Yeterof, steamed from her anchorage in the harbor. I was on deck before sunrise, but already we were out on the heaving water. Toward the south the terraced shores of Yezo could be dimly traced as far as the eye could reach. Toward the north the volcanic range of the Menashi Peninsula was capped with snow. At half-past eight we were abreast of Kunashiri at the point where Chia-chia towers as a regular volcanic cone and slopes on one side in graceful, unbroken concave to the sea. Shikotan had already been sighted and now lay close at hand on the starboard bow, while Yeterof was visible in the distance. But it was noon before we anchored in the harbor, entering through a beautiful narrow passage between high, bold, gray cliffs of sandstone, concealed here and there with patches of green. Within lies a quiet bay with a verdant valley, inclosed on every hand by mountains and brush-covered hills.

The settlement (Plate LXXV) consists of eighteen houses arranged on opposite sides of a single street which runs directly back from the sandy beach. The number of inhabitants is at present uncertain—one informant told us sixty, another sixty-five. They are in appearance a well-formed, hardy people, but they are fast dying off. Subsisting on the most miserable food, bulbous roots, green tops of plants, and a pittance of rice from the Japanese Government; not properly clothed, and unable to obtain the fish and other things which in their native isles were so abundant, disease, especially consumption, has made fearful havoc among them. In five years their number has decreased one-third. The Japanese are now trying to better their condition, but past neglect has done its work. The people can not subsist without aid where they now live, and in any event they will soon disappear from the face of the earth. The picture of the group here shown (Plate LXXVI) is probably the only one ever made of these people. It was taken on the beach just below the Japanese official residence, which is conspicuous in the picture. In the background may be seen many plain slabs marking the final resting-places of many poor souls who succumbed to the privations of a few years in a home not of their own choosing. It will be noticed that the people are clothed in European dress. This is because they have so long been under Russian influences. In winter they are accustomed to dress in skins, but whether they are able to provide themselves with such warm clothing from the resources of Shikotan is very doubtful.

The character of the dwellings will be more clearly understood from the illustrations than from any words of description. In a general way it may be said that each dwelling is composed of two parts, a front, thatched house, occupied in summer, and a winter earth house connected with the former by a covered passage.

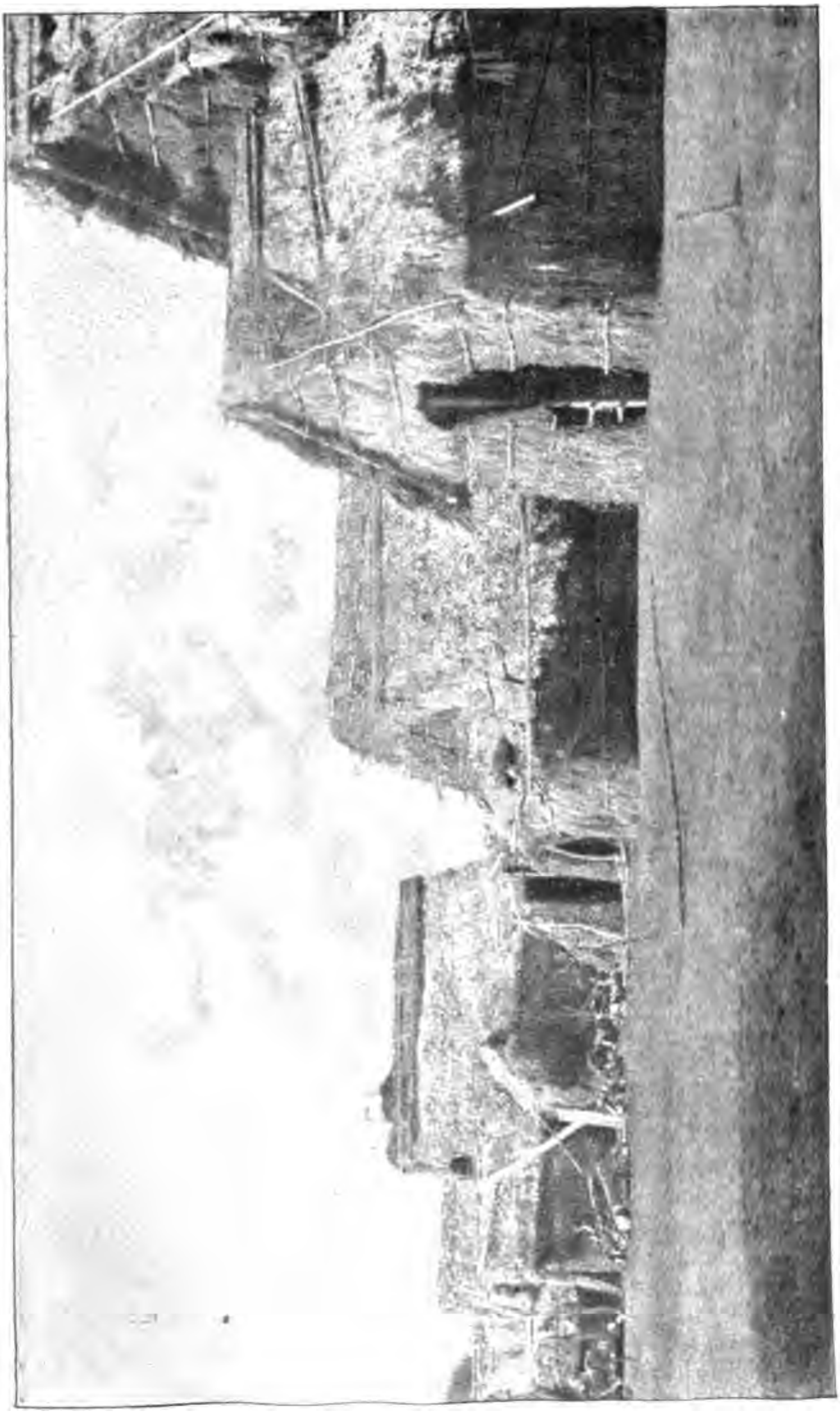
The thatched house very much resembles the houses of the Ainos. Plate LXXVII represents a view along the village street. There is the low front part used for storage and as a hall or passage-way, and the main portion which constitutes the living room. This room is usually nearly square, with a low door in front and a small door at the back opening into the passage which leads to the winter house. A good general view of a well-made house, and of the passage behind, is shown in Plate LXXVIII. Entering from the front we find in the main room a rude and very dirty floor of boards, raised six inches from the ground, leaving a small inclosed space near the entrance from which one may step up on to the floor. There is a large, rectangular fireplace sunk in the floor about the middle, on which pieces of wood fitfully burn and fill the house with smoke. The rafters and crossbeams are covered with a shiny coating of oily soot. There is a smoke-hole in the roof, but only the excess of smoke escapes. There are usually two small windows, one on each side, perhaps a foot square, and on one side a raised bunk with high side boards.

Above the fire hangs a Japanese iron pot containing a more or less unsavory stew. The pot is coated with accumulated deposits within and soot without, and is probably never washed, if it is ever quite emptied.

Around the walls hang articles of clothing, such as fur-lined gloves and shoes of fish-skin, rude baskets, skins of small animals, strips of hide for thongs, articles of dried fruit, etc.

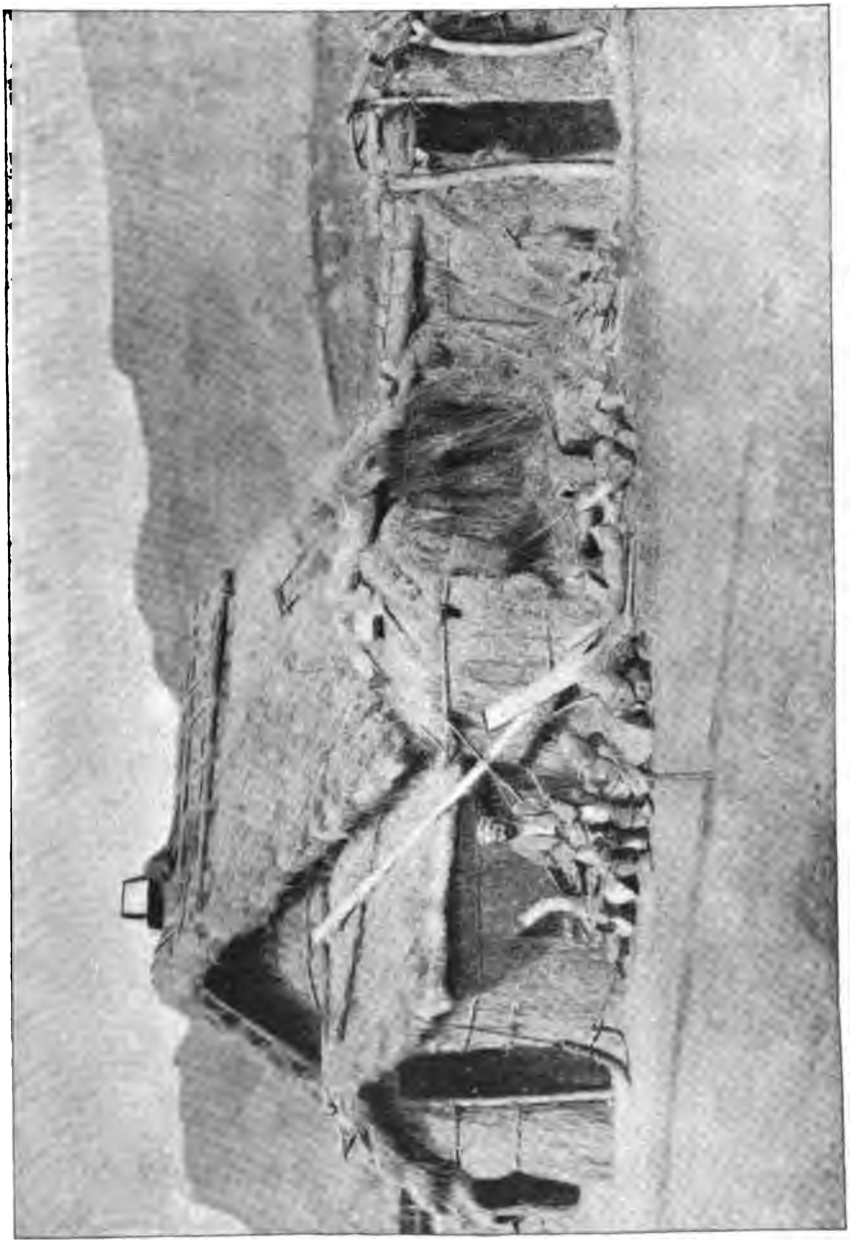
The winter house is of greater interest, because it probably represents the early pit-dwellings of Yezo. One of my pictures (Plate LXXIX) shows two such houses standing alone. These are at the upper end of the village, and they are the only ones not connected with thatched houses. As will be seen, they are dome-shaped mounds of earth, with windows and a sort of chimney. Usually there is one such mound, sometimes there are two, back of a thatched house, as will be understood by a glance at the next plate, which represents a view of the backs of the houses, showing the earth-dwellings attached.

The mounds are built over shallow excavations or pits in the ground about 12 to 18 inches deep. A plan of one of the dwellings (Fig. 65) shows the approximate size and proportions of the different rooms. The room of the earth-covered house on the left measured 2 metres wide,

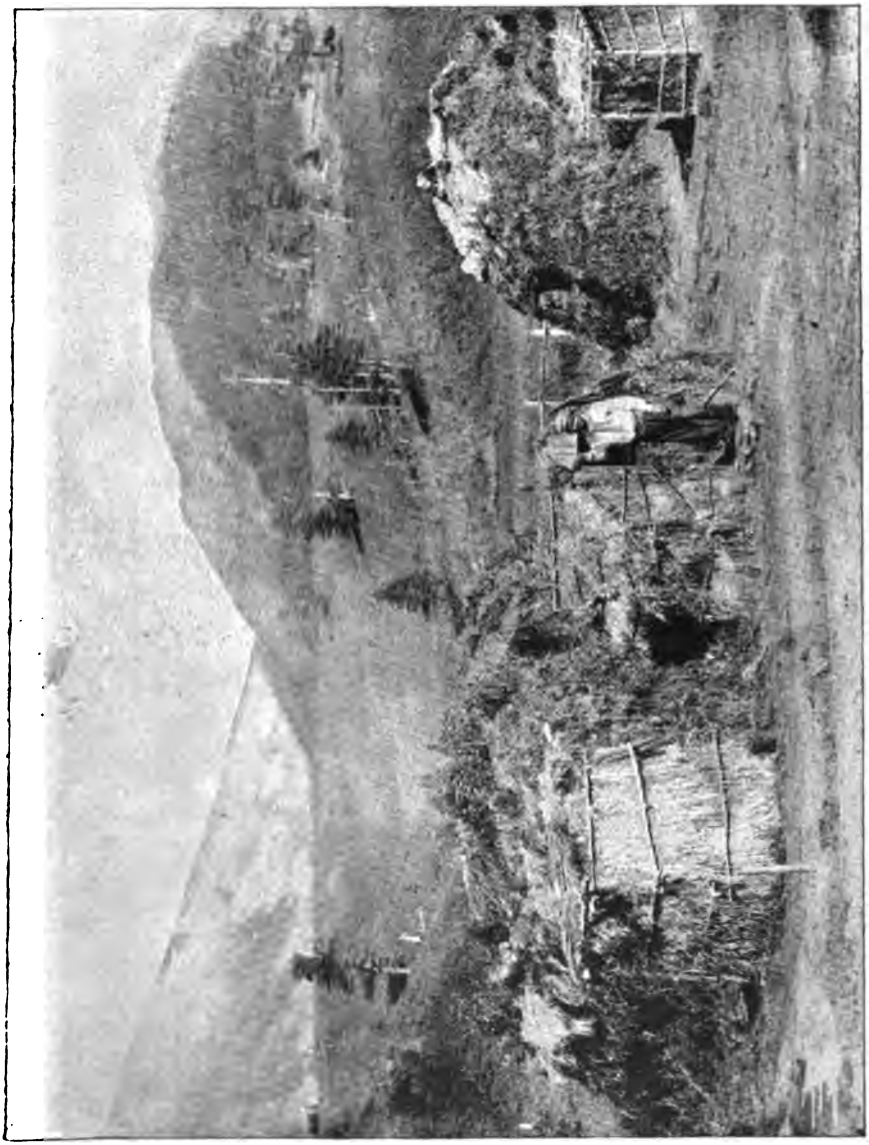


STREET SCENE, SHIKOTAN.

PLATE LXXVIII.



THATCHED HOUSE AND PASSAGE-WAY, SHIKOTAN.



EARTH HOUSES, SHIKOTAN.

2.25 metres deep, and 1.30 metres from the floor to the highest part of the ceiling. The beds were simply bunks, 38 centimetres from the floor and 60 centimetres wide. The entrance is through a small, low doorway from the covered passage. This passage may run quite across the back of the thatched house and extend some distance beyond it, as in the house shown in Plate LXXX, which is the one from which the plan is drawn. As one descends into the hut, it seems very damp and gloomy. There is nothing to be seen but the bare floor, the sleeping bunks on the sides, and the fireplace made by piling up rounded stones in one corner.

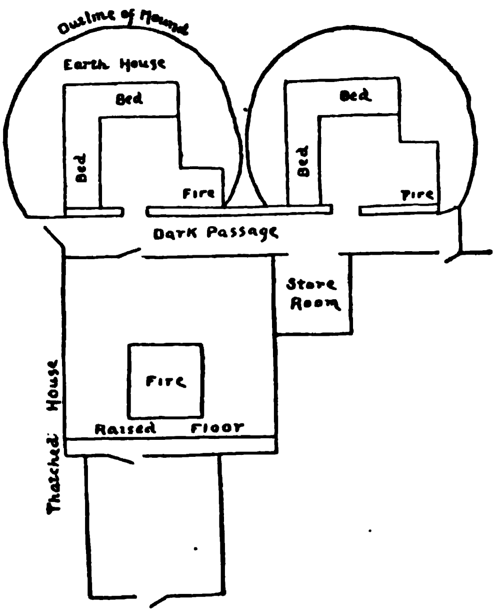


Fig. 65.
PLAN OF DWELLING, SHIKOTAN.

I have expressed the belief that these Shikotan huts are the modern representatives of the ancient pit-dwellings of Yezo. Perhaps it will be very difficult, or even impossible, to prove this connection; certainly the huts I saw were much smaller than many of the pits of Yezo, but I do not know what kind of a pit would be left by the falling in of one of these houses. I should think, after weathering a few years, it might not be very unlike the pits. On the other hand, it may be that the people, having learned to build better above ground, no longer require such large and deep subterranean huts as in the past, and that these shallow excavations are but survivals of the old plan of construction, which is no longer useful. However this may be, it would seem that the ancient pit-dwellers were driven from Yezo, perhaps by the Ainos, to the Kuriles, for the pits can be traced through Yeterof, and perhaps in the smaller islands beyond. The existence of the pits in Yeterof, the finding by Professor Milne of a small remnant of people on the same chain of islands who build houses over pits, and the finding of still others on Shikotan, may be fairly taken to indicate a connection between the people who dug the ancient pits and those who live in such dwellings at the present time.

There was very little to collect in the way of specimens to represent the people. M. Leroux was so fortunate as to find a single musical instrument of the form represented in Fig. 66. Not another could be found of the same shape, which will be recognized as of Russian design. The people were making others of different shape, evidently in imitation of the Japanese *samisen*.

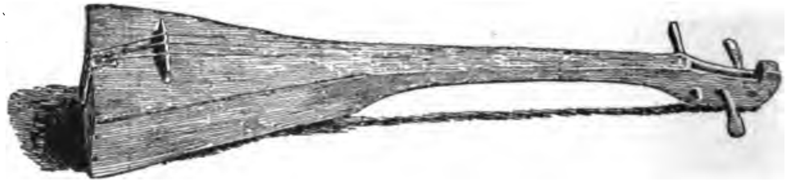


Fig. 66.
MUSICAL INSTRUMENT, SHIKOTAN.

Fig. 67 represents a carrying band used by women to carry their children on the back. The child sits in a curved wooden seat, and the band is passed over the chest of the bearer.

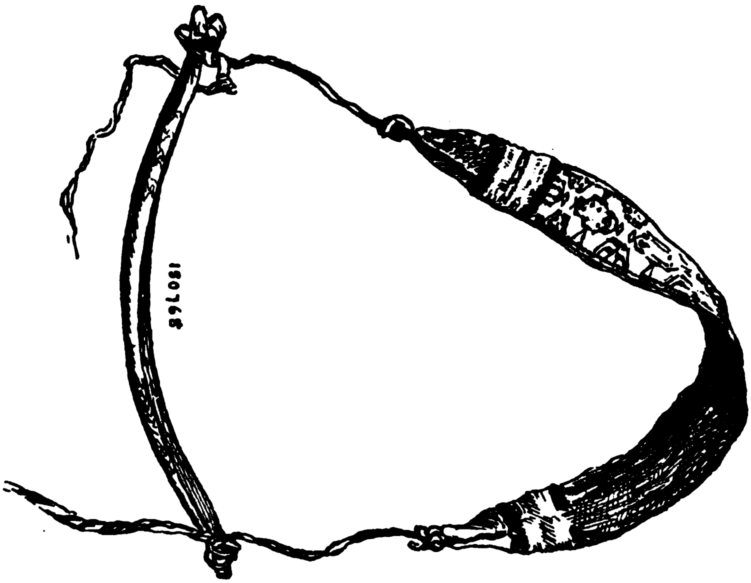
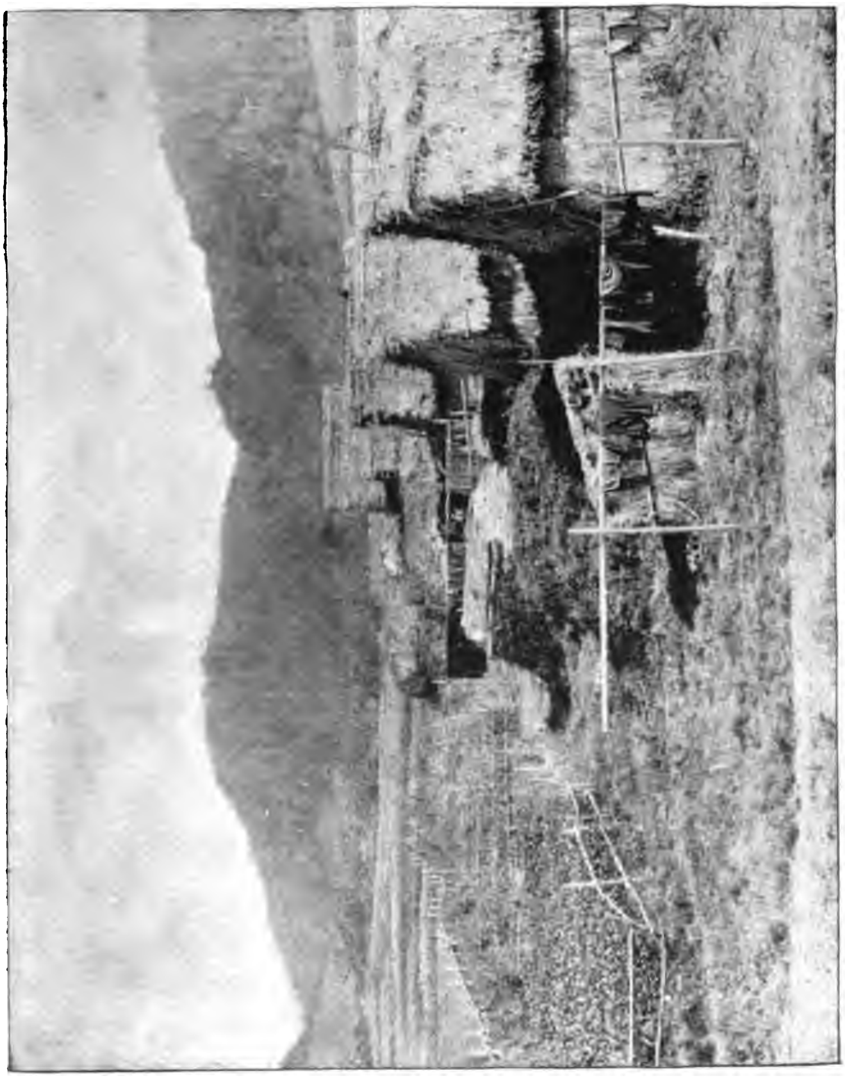


Fig. 67.
CARRYING BAND, SHIKOTAN.

We left Shikotan towards evening, bound for Yeterof. The rocky bluffs rose clear and sharp behind us, soon to be shrouded in a veil of

PLATE LXXX.



VIEW BEHIND HOUSES, SHIKOTAN.

mist, which in this region is constantly forming and reforming with endless changes in the scenery of shore and mountain. Early next morning we arrived at Shiana, a small fishing-station on the island, where a few Ainos and Japanese were found. At noon we were on board ready to start again, when suddenly a dense fog shut in around and held us, damp, cold, and miserable, in the little steamer until midnight. At half-past five the next morning we anchored at Bettobu, where we visited the pits already described, and then returned to Nemuro.

# THE AINOS OF YEZO, JAPAN.

By Romyn Hitchcock.

The island of Yezo is situated nearly north of the main island of Japan, stretching northeasterly, forming the end of the "silkworm," to which, owing to its shape, the Japanese writers have fancifully compared their country. It is comprised between the parallels of 41° 30′ and 45° 30′ of north latitude, and embraces about six degrees of longitude from the extreme western limit to the longitude of Nemuro. Nemuro is a large and important town situated near the extremity of the most eastern peninsula. It has a good harbor for small vessels, but the entrance is not very safe in bad weather. Looking north, the island of Kunashiri is clearly seen, its snow-capped mountains rising high and gleaming in the August sun. Further to the north and east are Yeterof, or Iturup, and the chain of the Kuriles stretching beyond to Kamtschatka. The Kuriles are, or have been, partly inhabited by a few migratory people who constructed a kind of underground dwellings which are of great interest in connection with the early inhabitants of Yezo.

Almost directly south of the eastern end of Kunashiri, about 50 nautical miles from Nemuro, is the small, almost unknown island Shikotan, in latitude about 33° 45′ north. On this island there is a small colony of the Kurile islanders established there by the Japanese Government. This was visited by the writer of this paper, whose observations there made are the subject of a separate report.

The northwest extremity of Yezo is separated by only about 20 nautical miles from Saghalien. The island is very irregular in shape. Geologically it is composed very largely of volcanic and metamorphic rocks, with here and there limited tracts of alluvium in river valleys and along the coast. The largest of these and by far the most favorably situated for agricultural purposes is in the Ishikari Valley. The Government agricultural college at Sapporo occupies some of the finest and most productive land, and has the advantage of a less rigorous climate than prevails in Yezo generally. At this place grain, vegetables and even fruits of fine quality are abundantly produced. Nevertheless, my observations do not enable me to speak favorably of Yezo as an agricultural country. The climate is too severe, and the soil is not generally suitable, or, where suitable, it is too limited in extent. The total production of rice in 1886 amounted to 16,595 koku (about 85,000 bushels) and of other grains, wheat, barley, and rye, 15,369 koku (79,000 bushels). These quantities are quite insufficient to sustain the population, which draws its principal supplies from the main island of Japan.

The island is well wooded. The spruce, chestnut, walnut, mountain ash, beech, birch, elm, maples, and pines are the most common trees. The maples in the north belong to the large-leaved variety, and are not the same as those of the main island of Japan, the leaves of which are very small. In many parts there is a thick, almost impenetrable undergrowth of scrub bamboo, scarcely exceeding 3 to 4 feet in height, but very unpleasant for the traveler. In the forests, one passes through mile after mile of this luxuriant growth, along narrow trails which can be followed only by an almost imperceptible depression in the general level of the green tops.

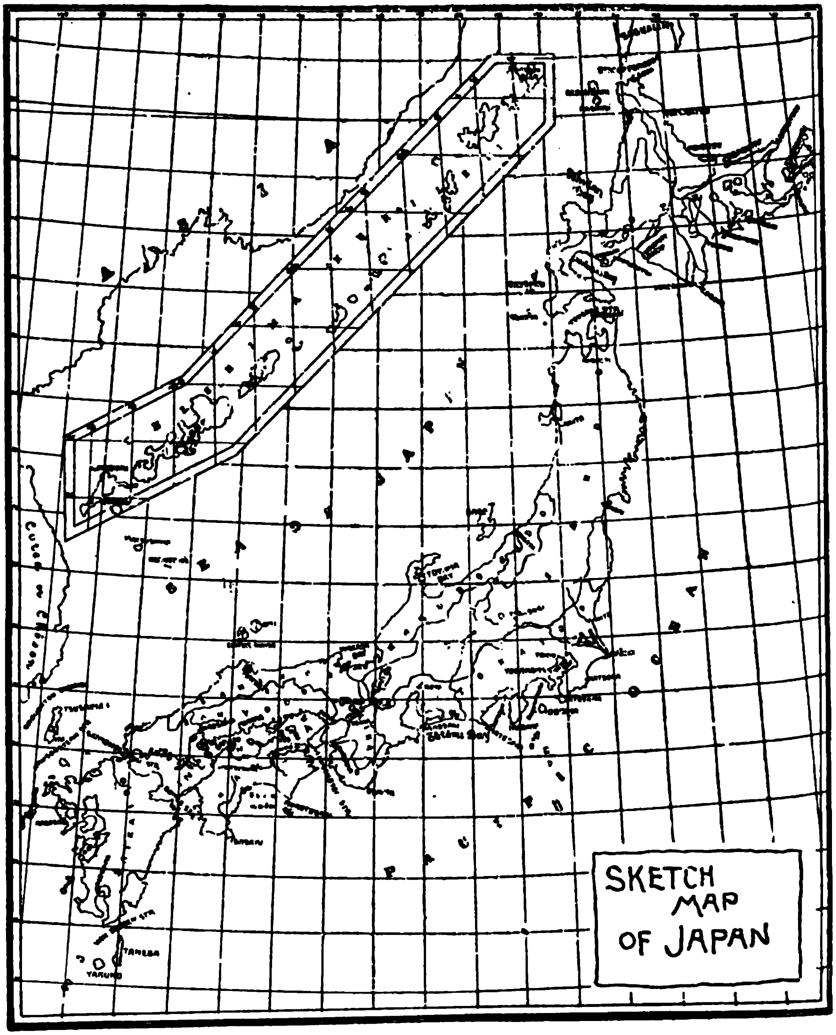


Fig. 68.

The principal Japanese settlements are Sapporo, Hakodate, and Nemuro. The population of the island is confined almost entirely to the coast. Small villages of Japanese and Ainos are scattered along the coast a few miles apart, wherever the locations are favorable for fishing or collecting seaweed. On the northeast coast the principal towns are Mombets, Abashiri, and Shari. Between Hakodate and Nemuro are Kushiro, Horoidzumi, Tomakomai, and Horobets. On some of the larger rivers, as the Ishikari, the Kusuri, and the Tokachi, there are small settlements of Ainos. On routes of travel far up in the mountains there will be found isolated stations, where one can obtain shelter and food with changes of horses. Otherwise the interior is an uninhabited wilderness, the abode of bears, foxes, and other animals.

The total population of the Hokkaido, which is the official designation of that section of Japan which includes Yezo and the islands off the northeast coast, is stated as 226,236. I am unable to state the number of persons on the island of Yezo alone, but there are very few on Kumashiri and Yeterof, and the Kuriles are practically uninhabited. Of this number about 16,000 are said to be Ainos. The distribution of the Aino population will be more fully considered in another place.

The principal support of this population is the fisheries, which are of great value. The following statistics of the fisheries were kindly furnished from the official reports by Mr. K. Ito, president of the Hokusui Kyokwai, or Northern Fisheries Society :

FISHERIES OF YEZO—PRODUCTION OF 1886.

| Fish. | Production. | Where exported. |
|---|---|---|
| | *Koku.** | |
| Spring salmon, *Masu*, salted | 5, 029, 489 | Main island. |
| Fall salmon, *Sake*, salted | 110, 729, 265 | Do. |
| Beche de mer, *Iriko* | 1, 027, 589 | 197,311 catties sent to China. |
| Seaweed, Kombu | 180, 373, 249 | 29,050,587 catties sent to China. |
| Oysters, dried | 4, 773, 040 | All sent to China. |
| Fish guano: | | |
| Herring | 572, 374, 304 | Other islands of Japan. |
| Salmon, *Masu* | 15, 511 | Do. |
| Iwashi (*Clupea melanostrata*) | 22, 259, 300 | Do. |
| Other kinds | 14, 595, 711 | Do. |
| Fish oil: | | |
| Herring | 7, 096, 905 | Unknown amount exported to United States. |
| Iwashi | 405, 600 | Do. |

* One koku of fish is about 333 pounds. One koku of oil is about 40 gallons.

## THE AINOS.

The Ainos are a peculiar race, quite distinct from the Japanese now found; a mere remnant of a once numerous people in Yezo and on the islands Kumashiri and Yeterof. The application of the name Aino requires to be more carefully restricted than it has been. In Yezo we hear of the Yezo Ainos, the Tsuishikari Ainos, and even of the Kurile Ainos. In this communication the name Aino is applied only to those people who are natives of Yezo. The Tsuishikari Ainos who recently came from Saghalien, and who are undoubtedly the same people but with slight differences in language and custom, will be invariably distinguished by the full name. The so-called Kurile Ainos are wrongly named. This name is given to the pit-dwellers of Shikotan, who are quite distinct from the Ainos. Mr. John Batchelor, of the Church Missionary Society, who has lived among the Ainos of southern Yezo for a number of years, and who has recently published a grammar of the Aino language and is about to publish a dictionary also, contends that the proper name for the people is Ainu. The best account of the Ainos of Saghalien is to be found in the very valuable work of Dr. L. Schrenck, "Reisen und Forschungen in Amurlande," vol. III. It has been said that the word was derived from the Japanese *inu*, meaning dog. This is what the Japanese assert, and they say that the Ainos are such an inferior race of people that they were called dogs. But Mr. Batchelor points out that the Japanese* more frequently derive the word from *ai-no-ko*, children of the middle. According to this author the word is not of Japanese origin, but, in the language of the people, means "men," descendants of Aioina. Aioina is the name of the first ancestor of the Ainos, who is worshiped as such by the people, but in English and also in German writings they have long been known as Ainos, and it seems unnecessary to make a change at this late day.

Formerly, it is said, the Ainos were subject to a powerful and wealthy chief, who lived at Piratori and received tribute from all the Ainos in the land. This is related by the Ainos themselves. However this may have been in the past, no traces of allegiance to a single ruler now remain. Each village has its own chief and a number of officers who assist him in preserving order and punishing wrong-doers. The chieftainship is hereditary in the family. It has recently been shown by the researches of Milne, Morse, Chamberlain, and others that Japan proper was once inhabited by a race of people different from the present Japanese, and from a comparison of the remains found in shell-heaps and kitchen-middens in many parts of Japan, even as far south as Kiushiu, with similar remains found in Yezo, it is thought that the Ainos once inhabited Japan. The evidence upon this subject seems at first sight rather conflicting, but on the whole it is tolerably conclusive. It is convincing if we consider only the probable, indeed the almost positive, Aino origin of geographical place-names in every part of the archipelago.† It is apparently weak if we consider only the very remote relations to be observed between the languages, mythologies, and customs of the present Ainos and Japanese. But on the other hand, if we seek to discover Japanese influences changing the habits and improving the condition of those Ainos who have lived in close contiguity with Japanese in Yezo for the last hundred years, we must confess that the signs of it are scarcely noticeable. The Aino in close contact with Japanese civilization remains, intellectually and otherwise, as much a savage in culture to-day as he ever could have been. It is true that some Japanese tales have found their way into Aino folk-lore, and a Japanese hero, Yoshistune, is reputed to have taught them useful arts. They number among their household treasures old Japanese swords and curios, which have been handed down from past generations. They now use Japanese knives instead of stone implements and metal arrow-heads in place of flint. But it is scarcely a century since they emerged from the stone age, and otherwise they have not passed beyond it.

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* Transasiatic Society Japan, XVI, 18.

† The Language, Mythology, and Geographical nomenclature of Japan viewed in the light of Aino Studies. Prof. B. H. Chamberlain.

We have here a remarkable instance of the close association of two distinct races, one superior and powerful, the other degraded and weak, working together day by day, living in contiguous villages, intermarrying more or less, and yet, after a century of such intimacy, as distinct in their character, habits of life, superstitions and beliefs as though they had never come together. The Aino has not so much as learned to make a reputable bow and arrow, although in the past he has had to meet the Japanese, who are famous archers, in many battles. It is a most remarkable example of the persistence of distinct types together, when the conditions are apparently favorable for the absorption of one by the other. The Ainos, being unable to affiliate more closely with the Japanese, remain distinct and apart, and are therefore doomed to extinction from the face of the earth.

As regards the evidence of place-names of Aino origin in Japan, a reference to Professor Chamberlain's valuable monograph shows that they are very widely distributed, even so far south as Kiushiu. Only a few examples will be quoted here to indicate the character of the evidence, the full strength of which can be brought out only by careful philological studies, such as the author named above has most ably carried out. Japanese geographical names are written with Chinese characters, which even the learned can not pronounce correctly without the aid of a geographical dictionary. These characters have meanings which may or may not throw light upon the origin of the name. For example, Otaru is an Aino place-name, meaning "sandy road." The reading of the Chinese characters is "small cask." Many examples of this kind show that the meaning of the Chinese characters may be very misleading. In the following list will be found a number of names illustrating the very absurd meanings in Japanese, and the Aino derivations proposed by Professor Chamberlain,

| Place-names. | Japanese. | Aino. |
|---|---|---|
| Izu | (Phonetic) | The promontory. |
| Izumo | Issuing clouds | The bay near the promontory. |
| Naki | Name tree | Stream. |
| Nabari | Name flat | The cliff by the stream. |
| Sabe | (Phonetic) | Dry river. |
| Sara | ...do | The grassy plain. |
| Tanabe | Rice-field name, tribe | Long river. |
| Tonami | Hares in a row | The stream from the lake. |
| Tsushima | Opposite horses | The distant island. |
| Uda | (Phonetic) | Sand. |

The distribution of names which are unquestionably of Aino origin, can be traced through the main island, and through Shikoku and Kiushiu, even into the extreme southern province of Osumi, and across the sea in the islands of Iki and Tsushima. "The dawn of history shows them (the Ainos) to us living far to the south and west of their present haunts, and ever since then, century by century, we see them retreating westwards under the pressure of the colonists from Europe." * * *

Evidently the Japanese Government can not, with the best of intentions, preserve the race much longer from extinction. If the Ainos once inhabited southern Japan, as the evidence of geographical place-names seems to prove, and if they have gradually been driven northward, their presence in the north of the main island within the historic period leads to the supposition that the early Japanese were the aggressors. If this were so, we would expect some allusion to the fact in ancient traditions and literature. The Japanese records of events previous to the historic period are exceedingly unsatisfactory, but it is significant that some of the half-mythical personages bear Aino names. Thus Tomibiko, for example, means nothing in Japanese, but the Ainos have the word *tumi*, "of war," which, in combination with the Japanese *biko* or *hiko*, "prince," gives us "Prince of war." The Ukashi are evidently the elders, from the Aino word *ekashi*. Instances like these might be multiplied.

According to Japanese records Japan was once inhabited by a race of dwarfs, who lived in underground dwellings—"earth-spiders," they were called. These were exterminated by the Japanese as the latter spread over the country. There are also allusions to a hairy race of savages called Yebisu, or Yemishi. This word is usually assumed to designate the Ainos, with whom the Japanese must have come in contact very early. It would appear, therefore, that the Japanese found the country inhabited by two different races, the so-called cave-dwellers and the Ainos, a supposition which seems not improbable in the light of recent ethnographic studies. In the preceding paper ("The Pit-dwellers of Yezo") the author has brought forward evidence to prove that certain excavations in the ground, quite numerous in Yezo, are the ruins of ancient dwellings, once inhabited by a people unlike the Ainos. The Ainos have, in fact, a tradition concerning such a race of pit-dwellers, or koro-pok-gune dwellers, under ground, which they claim to have exterminated. But it is impossible to determine whether this is a genuine tradition or an invention of the people to explain the existence of the pits. It is reasonable to suppose that they should have heard of the Smelenkur of Saghalien, who also live in half-underground dwellings. The Tsuishikari Ainos, who originally inhabited Saghalien, and who have customs somewhat different from the Yezo Ainos, say that their people* "used to live in underground houses called *toichioei*. In spring they forsook them and lived above ground until the frost and snow again made them seek shelter in these subterranean dwellings, which were pits roofed over, not caves."* Possibly the Saghalin Ainos are the more or less direct descendants of the ancient pit-dwellers, but it seems quite as likely that they have thus merely described the dwellings of the Smelenkur of Saghalien, with whom they must have been well acquainted. The Smelenkur seem to be a Mongolian people.

From the relics of the Stone Age and of the kitchen middens in Japan, Professor Milne concludes that the Ainos† once inhabited Japan as far south as Kiushiu. The remains are of the same character throughout the country, but they are more abundant in the north. The evidence that they are of Aino origin may be briefly summarized as follows:

(1) The designs on the pottery are the same as those on pottery found in Yezo, supposed to have been made by Ainos at a time when they possessed the art of making pots.

(2) Some of the shell-heaps occur in places known to have been occupied by Ainos. Historical evidence is clear that the Ainos formerly lived as far south as the thirty-eighth parallel, which is about the latitude of Sendai.

(3) The Ainos formerly used stone implements, presumably the same as those found with the pottery. Professor Milne presumes that the Japanese, entering the country from the south, chased the Ainos before them, while the Ainos in turn drove the pit-dwellers back toward Kamtschatka. There is, however, a missing link in the argument, because the present Ainos do not make pottery of any kind. It is scarcely probable that such a useful art, when once developed to the condition of elaborate artistic decoration shown by the vessels and fragments from the shell-heaps, should be utterly lost by a people. The specimens shown on Plate LXXXI will give an idea of the character of this decoration, which is far superior to anything found on Japanese sepulchral pottery. The only explanation that suggests itself which might account for the loss of this art by the Ainos is, that in gradually moving northward they passed into a region where they could not find clay for making their vessels. But this can scarcely be true, for fragments of ancient pots are found in Yezo mounds.

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* J. M. Dixon. The Tsuishikari Ainos. Trans. Asiatic Soc., Japan, XI, 1883, 39-50.
† Trans. Asiatic Soc., Japan, VII, 1879, 61-87.

Plate LXXXI represents a portion of a large and very interesting collection made up by M. l'Abbé Furet, of Hakodate. The specimens were obtained from various localities in Yezo and from Awomori, on the main island of Japan. It is scarcely within the province of this article to discuss this part of the subject at length, particularly since to do so would require numerous references to Japanese pottery, and many additional illustrations to present the subject clearly. Those who are already acquainted with ancient Japanese pottery will immediately recognize that these specimens are entirely different in form and decoration from any found in Japanese graves. Professor Milne states, as a historical fact, that the Ainos in the neighborhood of Nemuro "used flint instruments and manufactured pottery until late in the last century." The basis of this statement seems to be that Mr. Charles Maries saw in the houses of Ainos, near Horoidzumi, clay vessels in appearance very like the fragments from the shell-heaps, from which he concluded that the Ainos at that time still made pots; and further, that a book published in the year 1800 gives drawings and descriptions of pots at that time manufactured by the Ainos.

The evidence is not quite convincing. Professor Milne thinks the Ainos gave up making pottery because they could get it from the Japanese. But, as far as my observation goes, they do not use much pottery of any kind. Their implements are of wood, and if one occasionally finds a Japanese tea-set in an Aino house, it will be about the extent of their possessions of that kind of ware.

The shell-heaps furnish still further evidence of the early occupancy of Japan by a race certainly closely related to the Ainos. It is a peculiarity of the latter that the humerus and the tibia are very much flattened or platycnemic. Such bones have been found by Professor Morse in the shell-heaps, with indications of cannibalism among the people.

A Japanese writer has recently published a description of two peculiar huts still in existence in Shonai, on the west coast of Japan, which he believes may have been erected by the people who made the pottery of the kitchen-middens.*

If we may judge from the authority of old Japanese writings, and also from other evidence, such, for example, as the discovery of indications of cannibalism in the shell-heaps by Professor Morse, and the cruel modes of punishment brought forward by H. von Siebold, the Ainos were once a fierce and warlike people. They are now gentle and courteous in manner, and one can scarcely believe that they are descendants of cruel savages. Only once, while I was alone among them on the northeast coast, I had the misfortune to incur the displeasure of the chief man of the village, the largest Aino I saw in all my travels.

I had seen some of his people the day before, and had promised them

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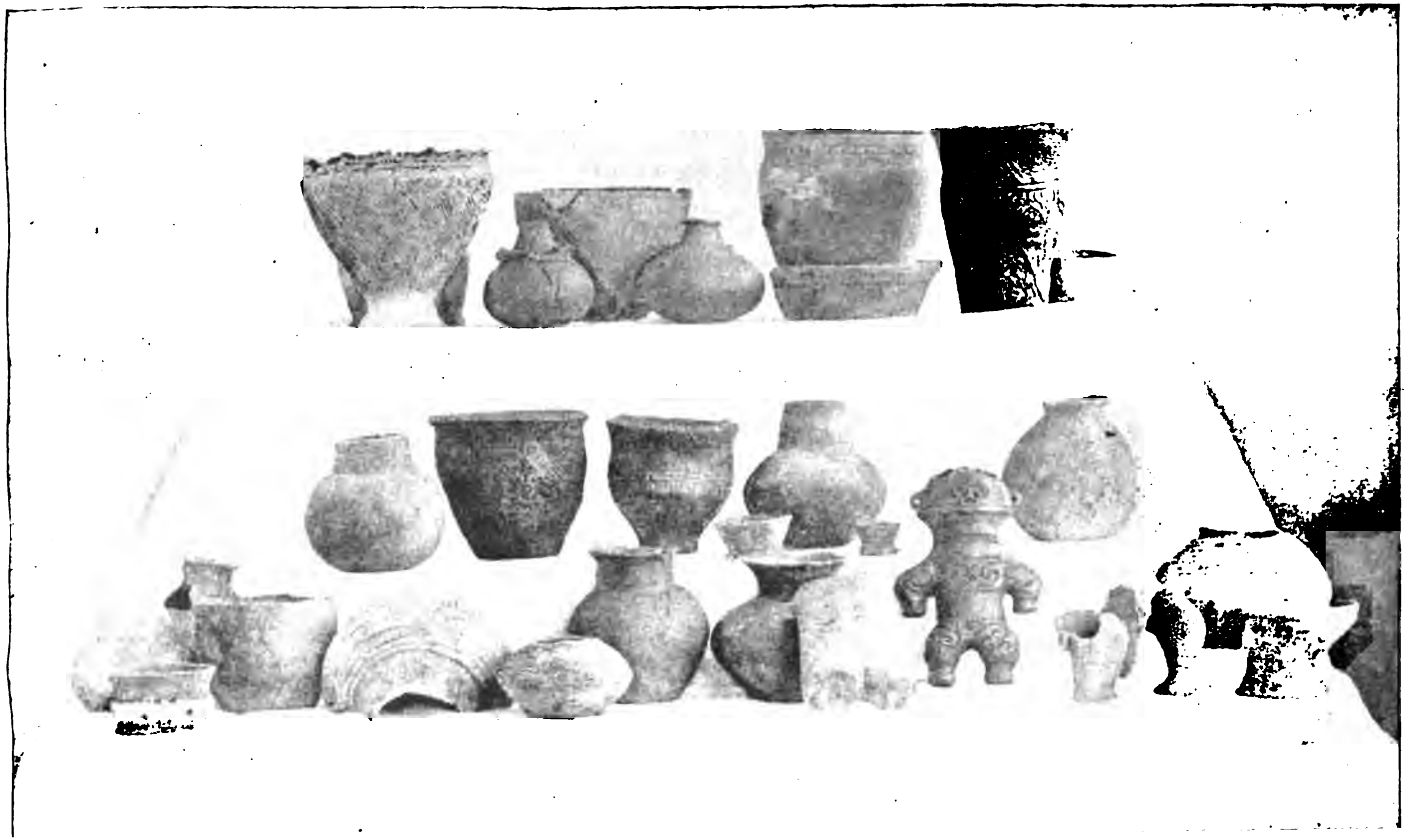
* Y. Hashiba. Dwellers in pits still found at Shonai. Bulletin of the Tokyo Anthropological Society, III (1888), 152. Printed in Japanese.



some saké in the evening. On returning to my hotel I ordered the saké to be sent to them, but the Japanese neglected to attend to it. Consequently when I went to photograph them the next day, just as I was about to take a picture of two old persons, the chief called out from a distance and my subjects turned away. I induced them to pose once more, when the burly chief came on a run, forcibly threw his offending subjects on either side and turned to me with fire in his eye and some very strong language, no doubt, of which I could not understand one word. I thought he would smash my camera, and he might easily have thrown me into the sea. However, by degrees he cooled down and finally he stood for his own picture in a pose of his own, neither graceful nor elegant. But he came on me like a type of a fierce high-tempered savage, such as I do not care to encounter again.

There is an account of the Ainos of six or seven centuries ago, which tallies well with the supposition that they were once a warlike people. It is from a report of Mr. Henry S. Munroe, and relates to the discovery of gold in Yezo. According to the Japanese tradition, a party of Japanese in the second year of Genkiu went to Yezo and remained there 13 years washing for gold. The account goes on to say : "At this time the Ainos were a very savage and warlike race and gave the gold-washers no little trouble. Finally after a desperate battle, the Ainos became masters of the field, killing the whole party of Japanese with the exception of the priest. * * * The Ainos emboldened by the victory, crossed the straits in large force and made vigorous war on the Japanese."

### AINO POPULATION.

In an article published in the Japan "Mail" of January 20, 1888, Mr. John Batchelor has given the following statistics of the Aino population of Yezo for four successive years. His figures are as follows:

*Aino population in Yezo.*

| Year. | Males. | Females. | Total. |
|---|---|---|---|
| 1882 | 8,546 | 8,652 | 17,198 |
| 1883 | 8,554 | 8,596 | 17,150 |
| 1884 | 9,051 | 8,776 | 17,827 |
| 1885 | 7,900 | 8,063 | 15,963 |

The cause of the decrease in 1885 is not explained. It amounts to 1,864 and includes 1,151 males and 713 females. I am disposed to regard it as an error in the returns, not at all impossible in Japanese methods. In the course of my own travels I endeavored to obtain definite information concerning the population, not with the view of learning the total number of Ainos in Yezo, which could only be done by visiting all parts of the island, but for the purpose of enabling future travellers to know where the largest settlements are to be found.

That this is an important consideration was well illustrated in my own experience. No doubt there are officials at Sapporo, the seat of government, and perhaps also in Hakodate, who can give such information, but I was quite unable to get any knowledge whatever as to the existence or non-existence of any considerable number of Ainos on the northeast coast of Yezo. I went to Hakodate intending to sail directly to Nemuro, and to go from there as far as possible to the north, but from the information I received at Hakodate, I was led to change my plan, and concluded to come back along the southeast coast over the well-known routes of travel. But at Nemuro I was so fortunate as to meet a gentleman who had been farther north, and from his observations I was led to resume my original plan, much to my satisfaction; for the Ainos of the south are well known to foreign travelers, while those in the north have scarcely been seen except by Japanese.

The population of the places mentioned below was very courteously given me by the local Japanese officials. There may be serious errors in spelling the names of villages, but I have endeavored to convey the sounds as well as I could catch them from the Hokaido Japanese, which it was always difficult for me to understand.

| Town or village. | Houses. | Males. | Females. | Total. |
|---|---|---|---|---|
| NEMURO. | | | | |
| Bitskai | 14 | | | 56 |
| Shibetsu | | 20 | 20 | 40 |
| KITAMI. | | | | |
| Shari: | | | | |
| Shimatokai | 11 | 10 | 12 | 22 |
| Shari | 45 | 62 | 64 | 126 |
| Yambetsu | 7 | 11 | 9 | 20 |
| Abashiri: | | | | |
| Abashiri | | 14 | 8 | 22 |
| Kitami Machi | | 21 | 18 | 39 |
| Noyori | | 7 | 4 | 11 |
| Notori | | 3 | 6 | 9 |
| Nikuribaki | | 6 | 6 | 12 |
| Mukudo | | 5 | 7 | 12 |
| Naiyori | | 7 | 6 | 13 |
| Tombetsu | | 6 | 6 | 12 |
| Miboro | | 15 | 11 | 26 |
| Kakumi | | 5 | 4 | 9 |
| Dapi | | 9 | 8 | 17 |
| Ponkigin | | 5 | 4 | 9 |
| Kimitambi | | 9 | 9 | 18 |
| Furumi | | 9 | 5 | 14 |
| Tokoro | 35 | 50 | 56 | 106 |
| TOKACHI. | | | | |
| Akkeshi: | | | | |
| Waktakecho | | 2 | 5 | 7 |
| Matsubacho | | 61 | 55 | 116 |
| Homtomura | | 2 | | 2 |
| Shinriuwu | | 12 | 14 | 26 |

| Town or village. | Houses. | Males. | Females. | Total. |
|---|---|---|---|---|
| TOKACHI—continued. | | | | |
| Tokachi: | | | | |
| Tokachi | 1 | 1 | 3 | 4 |
| Obetsukowashi | 9 | 18 | 13 | 31 |
| Aiushi | 2 | 2 | 4 | 6 |
| Osansu | 4 | 6 | 6 | 12 |
| Tafukurai | 30 | 54 | 41 | 95 |
| Tobutsu | 6 | 12 | 16 | 28 |
| Kinashiba | 10 | 22 | 17 | 39 |
| Nakagawa: | | | | |
| Nobutori | 11 | 25 | 29 | 54 |
| Horokenashiba | 4 | 7 | 7 | 14 |
| Ponbetsu | 20 | 45 | 47 | 92 |
| Chiota | 14 | 14 | 35 | 49 |
| Yamuwatkahira | 20 | 46 | 41 | 87 |
| Ikanbetsu | 13 | 28 | 42 | 70 |
| Chirott | 22 | 24 | 27 | 51 |
| Bett | 6 | 9 | 13 | 22 |
| Kasai: | | | | |
| Fushikobetsu | 21 | 57 | 50 | 107 |
| Memurobetsu | 59 | 151 | 144 | 295 |
| Sachinai | 9 | 22 | 23 | 45 |
| Urekorept | 3 | 7 | 8 | 15 |
| Katou: | | | | |
| Otofuke | 31 | 79 | 81 | 160 |
| Tobuti: | | | | |
| Herofune | 3 | 5 | 7 | 12 |
| Taiki | 5 | 19 | 15 | 34 |
| Biroo: | | | | |
| Moyori | 49 | 84 | 77 | 161 |
| HIDAKA. | | | | |
| Urakawa | 154 | 540 | 580 | 1,120 |
| Mitsuishi | 67 | 194 | 191 | 385 |
| Shidzunai | 374 | 778 | 891 | 1,669 |
| Nikap | 136 | 321 | 307 | 628 |
| Saru: | | | | |
| Sarufuto | 9 | 34 | 27 | 61 |
| Hiraka | 27 | 75 | 77 | 152 |
| Shinukotsu | 28 | 55 | 68 | 123 |
| ——? | 22 | 38 | 48 | 86 |
| Piratori | 61 | 103 | 104 | 207 |
| ——? | 34 | 77 | 88 | 165 |
| ? Nioi | 37 | 80 | 92 | 172 |
| ? Ogashirunnaye | 12 | 28 | 27 | 55 |
| ? Horosari | 29 | 69 | 71 | 140 |
| ? Kankibetsu | 10 | 28 | 20 | 48 |
| Monbetsu | 20 | 73 | 53 | 126 |
| ——? | 5 | 22 | 19 | 41 |
| Gabari | 25 | 55 | 68 | 123 |
| Harabetsu | 19 | 43 | 54 | 97 |
| ——? | 4 | 7 | 6 | 13 |
| Shamani | 62 | 170 | 158 | 328 |
| Horoidzumi | 23 | 27 | 28 | 55 |
| IBURI. | | | | |
| Yuufutsu | 240 | 499 | 521 | 1,020 |
| Shiraoi | 132 | 296 | 271 | 567 |
| Chitose | 74 | 140 | 127 | 267 |

### PERSONAL APPEARANCE.

In describing the Ainos it must be said that, unless otherwise stated, the word Aino, as used by the present author, is restricted to the Ainos of Yezo. The importance of this distinction may be seen by comparing the group of so-called Tsuishikari Ainos (Pl. LXXXII), and the single and very excellent type shown in Plate LXXXIII, with the group of Yezo Ainos from Abashiri in Plate LXXXIV, and in the succeeding illustrations. In the Abashiri group the man sitting cross-legged near the the middle undoubtedly belongs to the Tsuishikari type. The latter came from Saghalin in 1875 and settled in the rich valley of the Ishikari to the number of seven or eight hundred. They were visited by Mr. J. M. Dixon* in the year 1882. At that time he found them about 12 miles from Sapporo, at the junction of the Ishikari and Toyohira Rivers. When I reached Sapporo in 1888, intending to visit them, I learned that they had all moved to Atsuta, about 26 miles from Sapporo, on the Ishikari. Unfortunately I was unable to visit them, but through the courtesy of Mr. H. Sato, of the Sapporo Agricultural College, I was able to secure a valuable collection of articles from them, which are now in the Museum.

The Tsuishikari Ainos differ in several respects from the Ainos of Yezo. The men are distinguished by a peculiar manner of shaving the hair back from the forehead. Mr. Dixon says they also "cut their hair at the back into the neck." The women have bright, pleasing faces, and tattoo the mouth, like the Yezo Ainos, with a broad band reaching well to the ears. Their utensils differ slightly from those found among the Yezo Ainos, and their language is similar, but not quite the same. The two wooden dishes represented in Fig. 69 are quite different from any which I saw among the Yezo Ainos. The one marked 150774 is said to be used as a rice bowl. It is 12 inches in length. The other, 150777, is presumably a fish plate. The Ainos are characterized by a strong growth of hair about the legs and body, long black hair on the head, and heavy beards. Writers have occasionally asserted that the Ainos are not generally more hairy than other people, but I have elsewhere shown how such an error might be explained. My own observations of what I regard as a purer Aino stock than is usually seen by travelers in Yezo, have convinced me that great hairiness of the body is a strong characteristic of the Aino men, and the evidence of this is to be seen in the photographs which I have brought home.

The Ainos are small in stature, although rather larger than the Japanese. They are more strongly built, and doubtless endowed with greater powers of endurance. In color they are rather brown than yellow, but scarcely darker than the Japanese. On this point, however, it is difficult to speak with confidence, for they do not bathe or wash, and the natural color of the skin is not often seen. The hair and beard,

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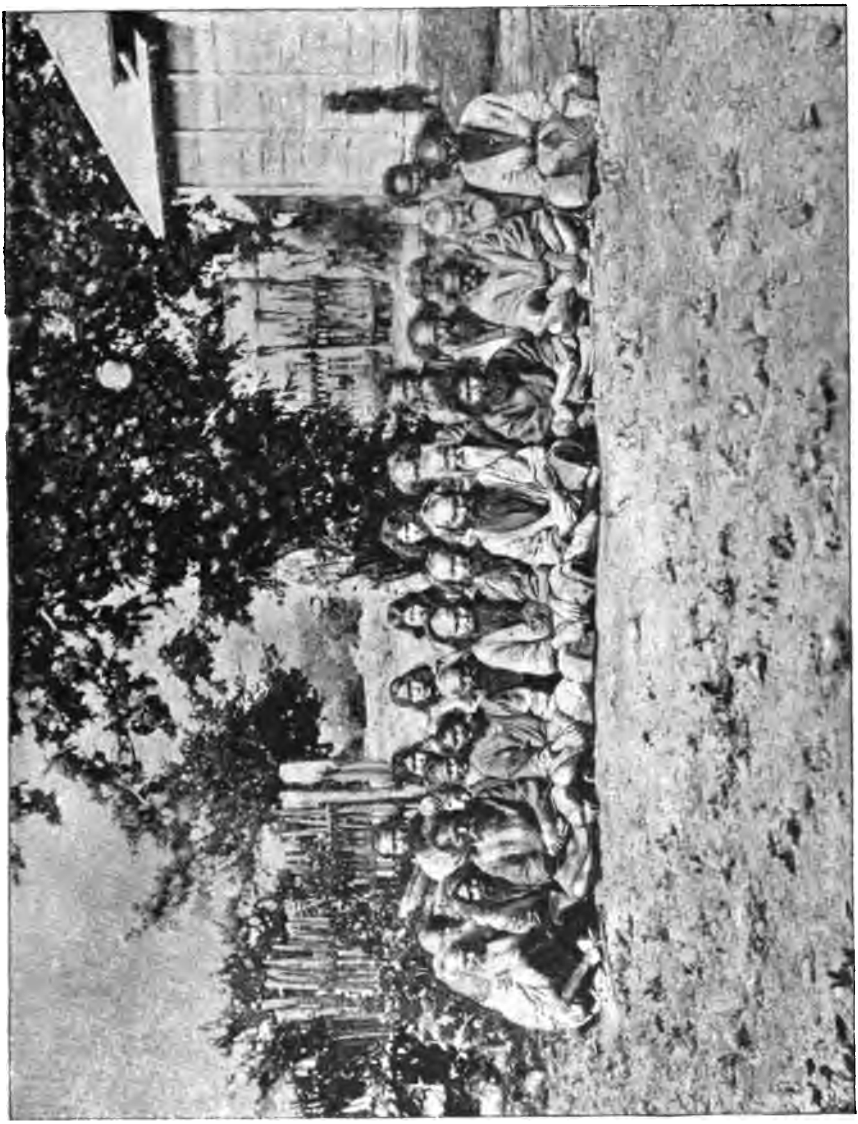
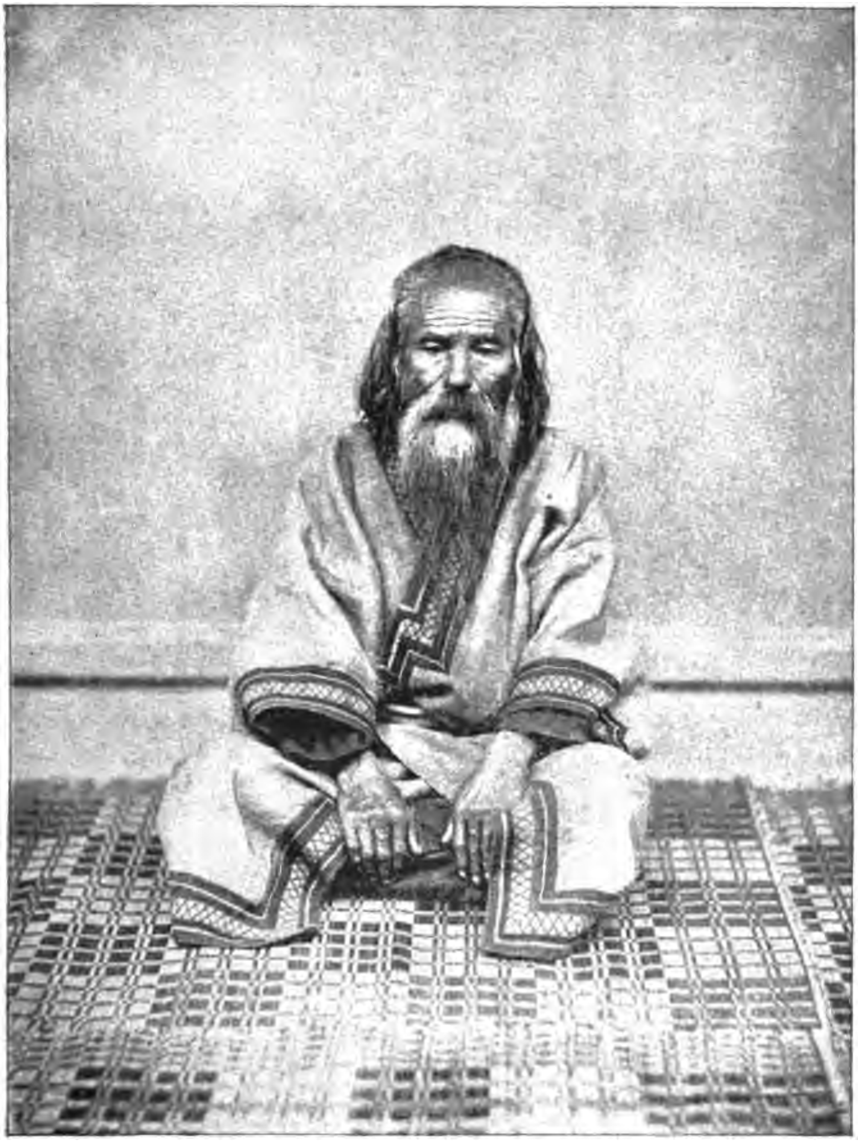
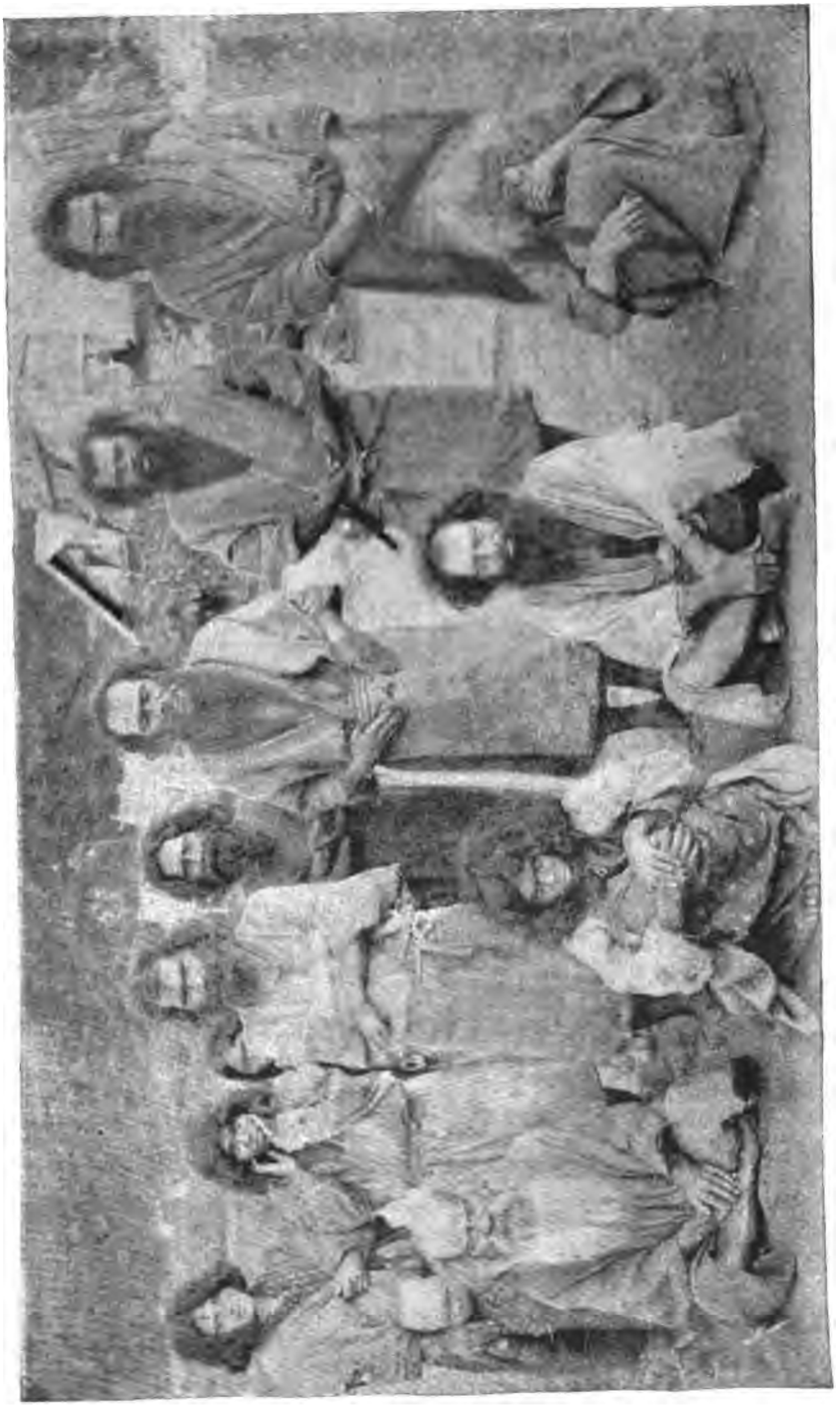
* Trans. Asiatic Society Japan, XI, 33–50.



TSUISHIKARI AINOS.



TSUISHIKARI AINO.



GROUP OF AINOS, ABASHIRI.

which are thick and bushy, are allowed to grow to full length, and they are never combed or brushed. Consequently an Aino at home presents a very uncouth appearance. Nevertheless, it is evident enough that most of them would be fine-looking men if they could be induced to bathe, comb their hair, and put on good clothes. Although ignorant and superstitious, they do not look like savages or barbarians. Their manners are gentle, their voices soft and pleasing.

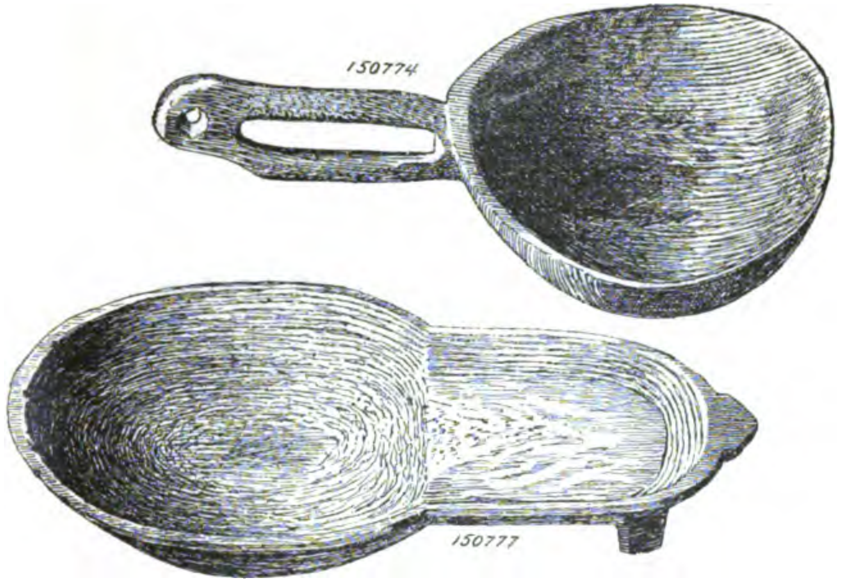


Fig. 69.

RICE-BOWL AND FISH-PLATE, TSUISHIKARI AINOS.

Good types are shown in Plates LXXXV–IX. The hairiness of the body is best shown in Plates LXXXVII–IX. The old man (Pl. LXXXIX) at the door of his house is covered with long hair on the breast and shoulders, which is much more conspicuous than appears in the photograph. The young women are often comely and attractive. The young girl (Pl. XC) is not devoid of the many feminine instincts of a coquettish society belle. But she was capable of making a good bargain for the work of her hands, as I found when I purchased some of her embroidery.

The Japanese in Yezo are quick to recognize the good qualities of Aino women, and many of them marry Aino wives. As the women grow older, they quickly lose the bloom of youth, becoming worn and wrinkled, no doubt from the exposure and hardship of their rough lives. Two good types from the northeast coast are represented in Plate XCI.

The faces of the women are disfigured by tattooing around the mouth, the style of which varies with the locality. Young maidens of six or seven have a little spot on the upper lip. As they grow older, this is gradually extended until a more or less broad band surrounds the mouth and perhaps extends in a tapering curve on both cheeks toward the ears. The arms also are tattooed in various patterns. The tattoo marks are made by cross-hatching the skin with knives, which they get from the Japanese. Into the cuts thus made the soot of burning birch (*kaba*) bark is rubbed, which is collected on the bottom of a dish held over the fire. The color of the marks thus made is distinctly bluish, and for this reason it does not show so conspicuously in photographs as it appears to the eye. The width and extent of the tattoo marks, as well as the depth of the color, is different in various parts of Yezo. In the north it is a narrow band on both lips, not very conspicuous, as shown in the picture of two young women of Tokoro, Plate XCII. At Ohotsu, on the southeast coast, the bands are wider, but not much extended on either side of the mouth, and the color is almost black. This pattern is seen also about Urap (Pls. XC and XCIII.) In other localities the band is very broad and well extended towards the ears, as shown in Plate XCIV, but in this case the color is in wavy lines and not deep.

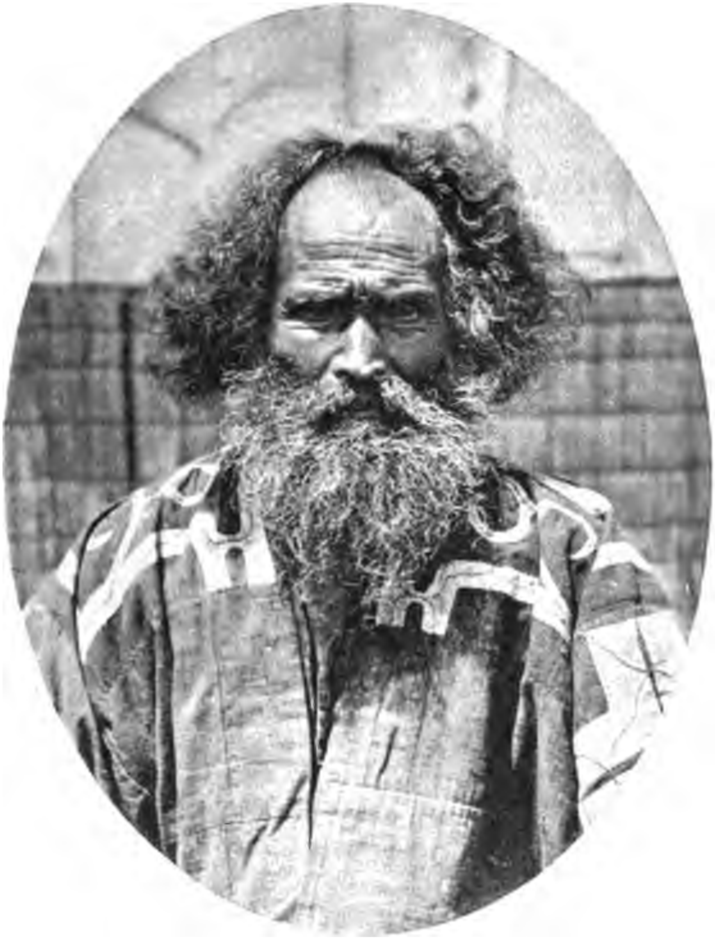
On the road from Tamakomai to Sapporo I met two women with vertical tattoo marks on the forehead between the eyes. This observation was only casual and therefore not entirely satisfactory, for I supposed it would be possible to further verify it by visiting some of the villages in that region. This I was unable to do. But the practice of tattooing the forehead has been noted by other observers. Mr. Batchelor has casually mentioned that the Aino women "in some cases tattoo their foreheads." This, as well as an allusion to the fact by Dr. Scheube, confirms my own observation. Prof. H. E. Stockbridge, with whom I have since spoken on the subject, informs me that he has frequently noticed this form of tattooing, and that it seems to be most common along the west coast.

The tattoo marks on the arm are best shown in Plate XCV, which represents an old woman of Tokoro. The patterns vary greatly in different cases, but they all have the same general character of alternating horizontal lines and crossed lines.

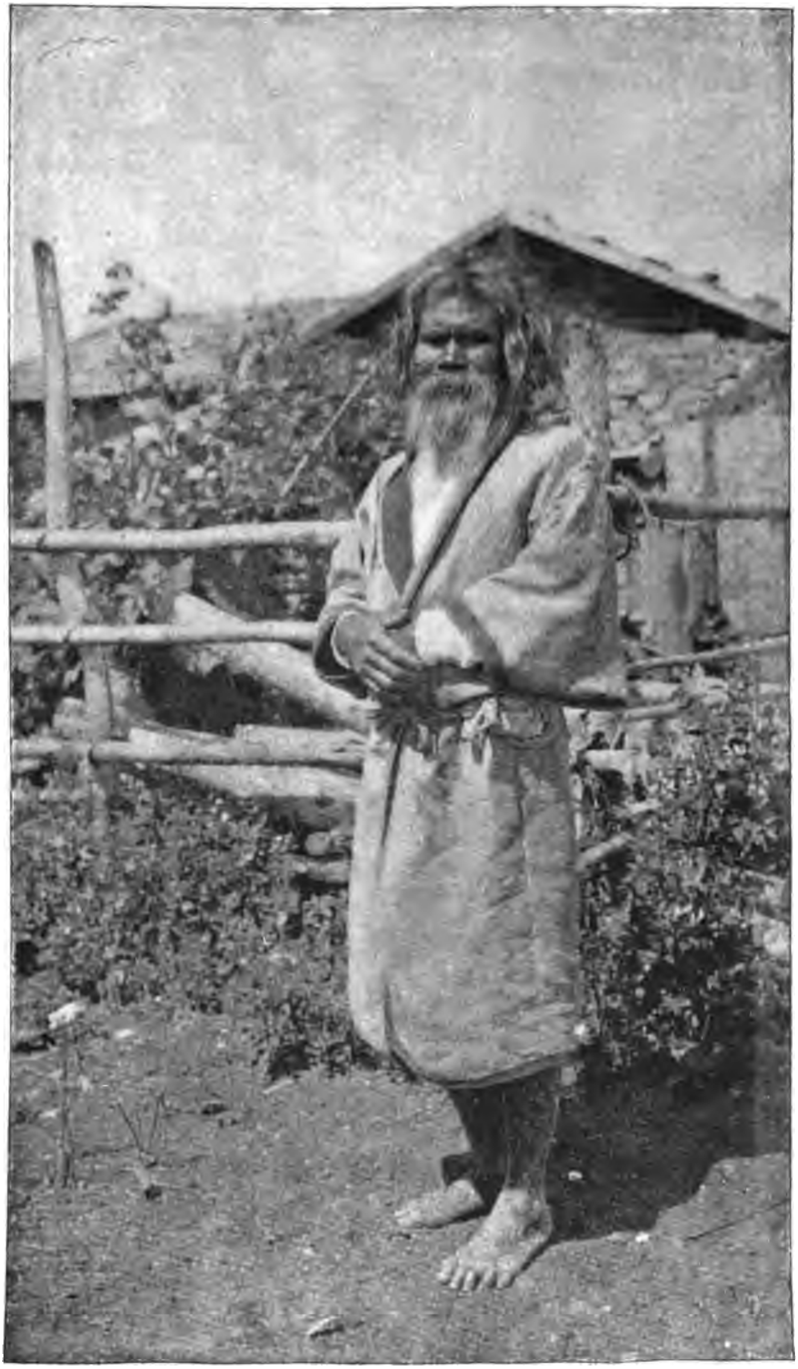
The origin and significance of tattooing among the Ainos is obscure. It seems to be merely an inherited custom without any recognized object.

## STAGE OF CULTURE.

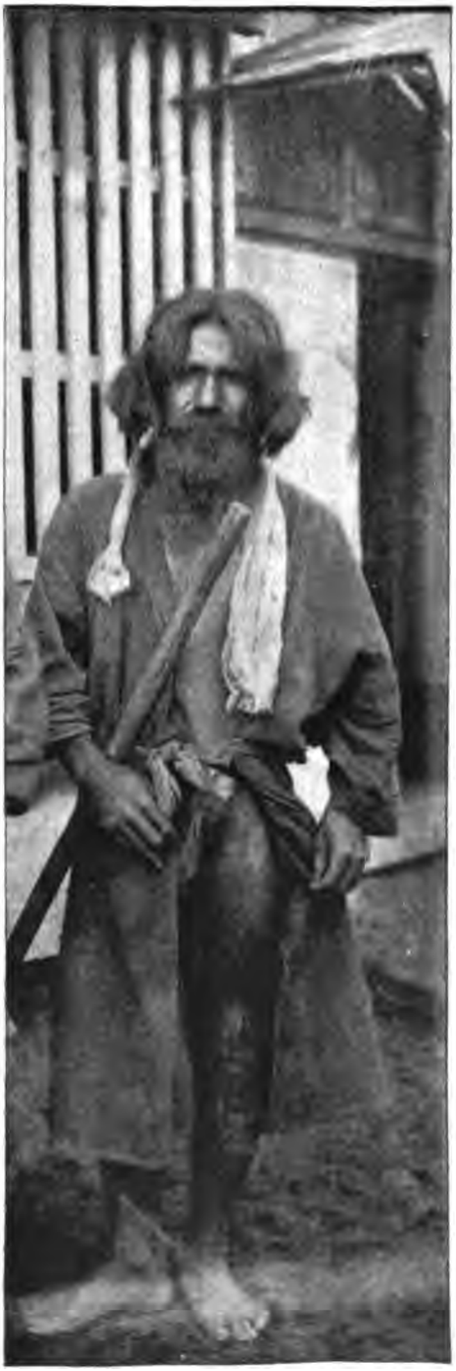
Probably few who read these lines have ever seen the lower stages of human savagery and barbarism, still less have they an adequate conception of the physical and moral condition, or of the manner of life, which characterizes the lower types of human existence. The American Indian is a picturesque character as we think of him roaming over plains and through forests, hunting the buffalo and other wild animals, sleeping peacefully in his wigwam, and enjoying the fruits of a luxuriant soil. But come nearer, and we find that the hunt is for



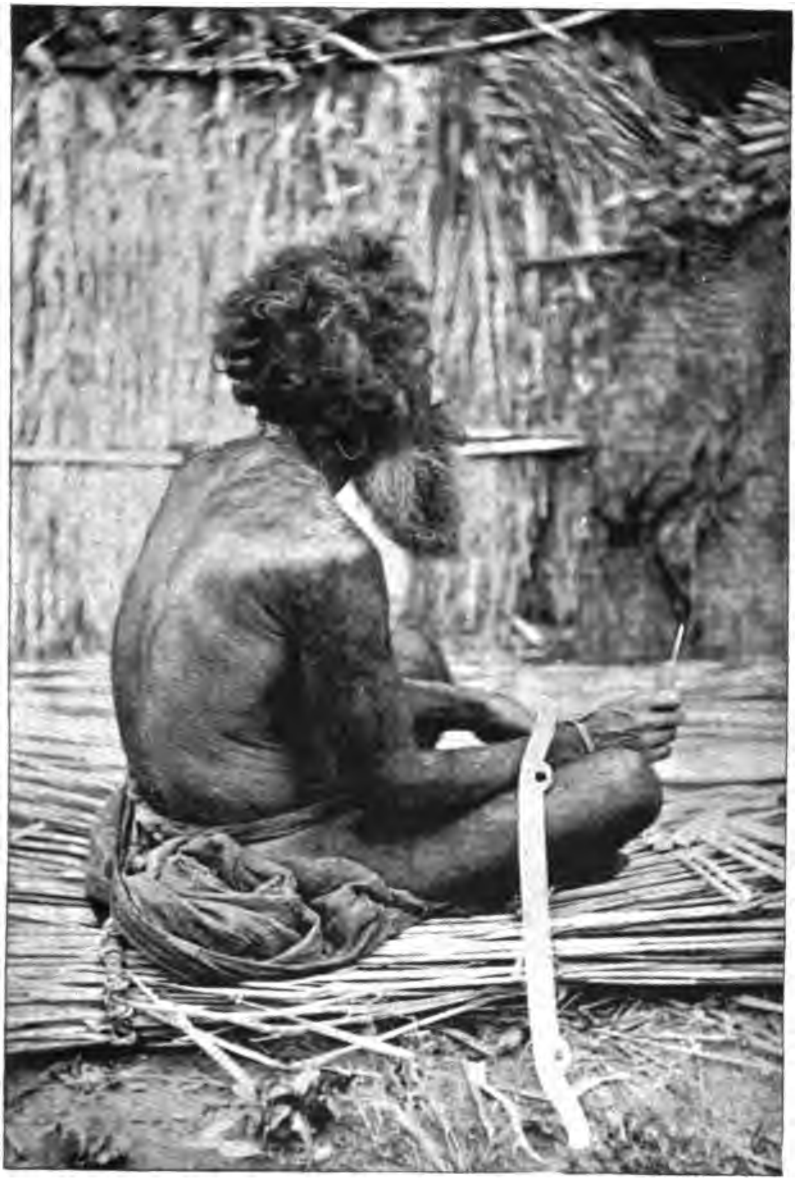
AINO, URAP.



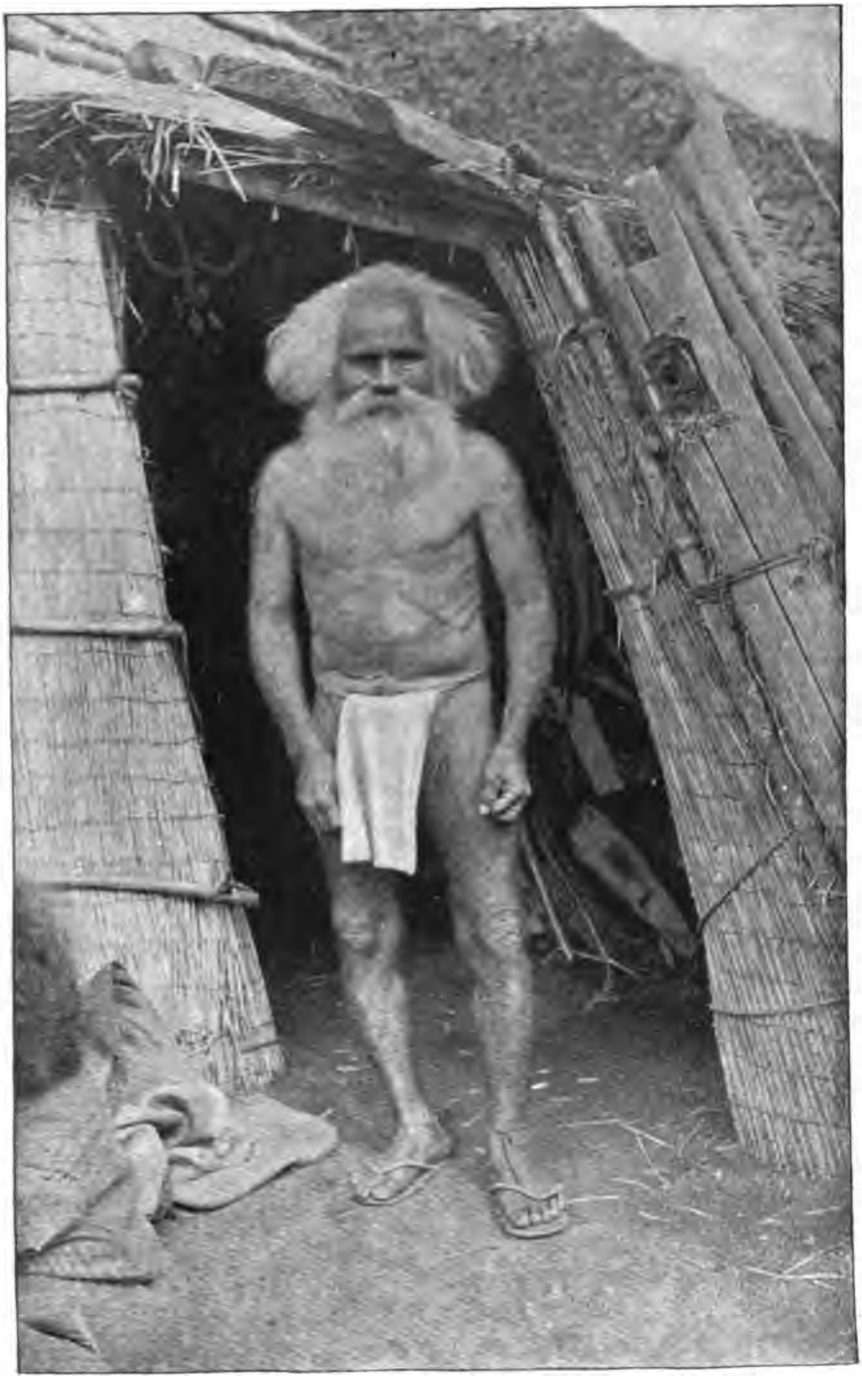
AINO, ABASHIRI.



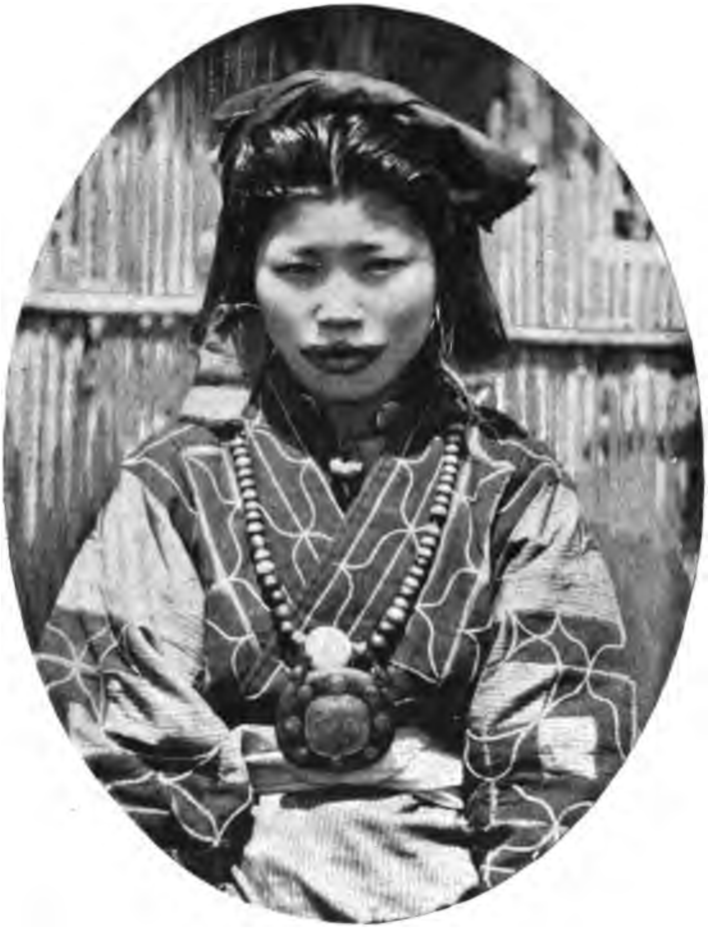
AINO, ABASHIRI.



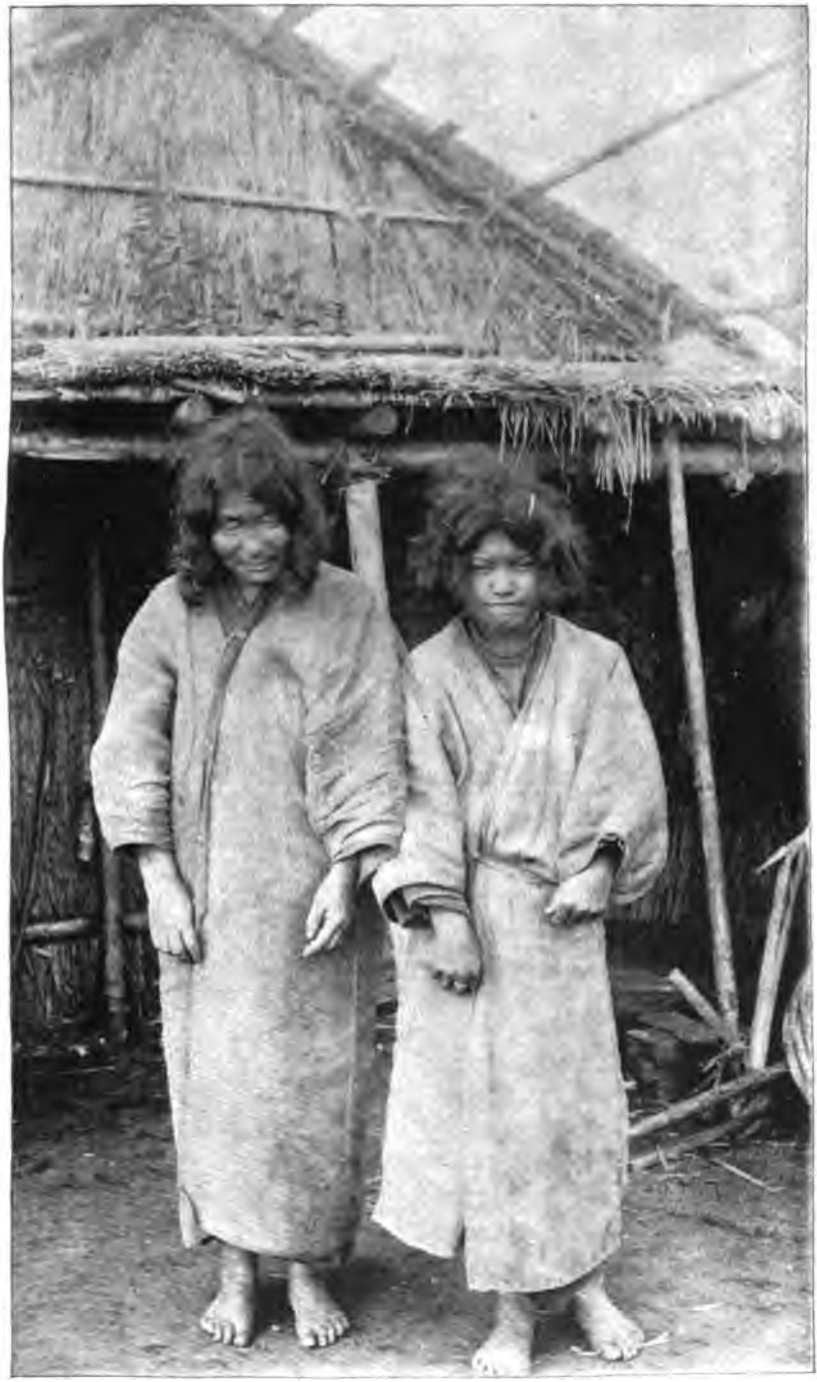
AINO, URAP.



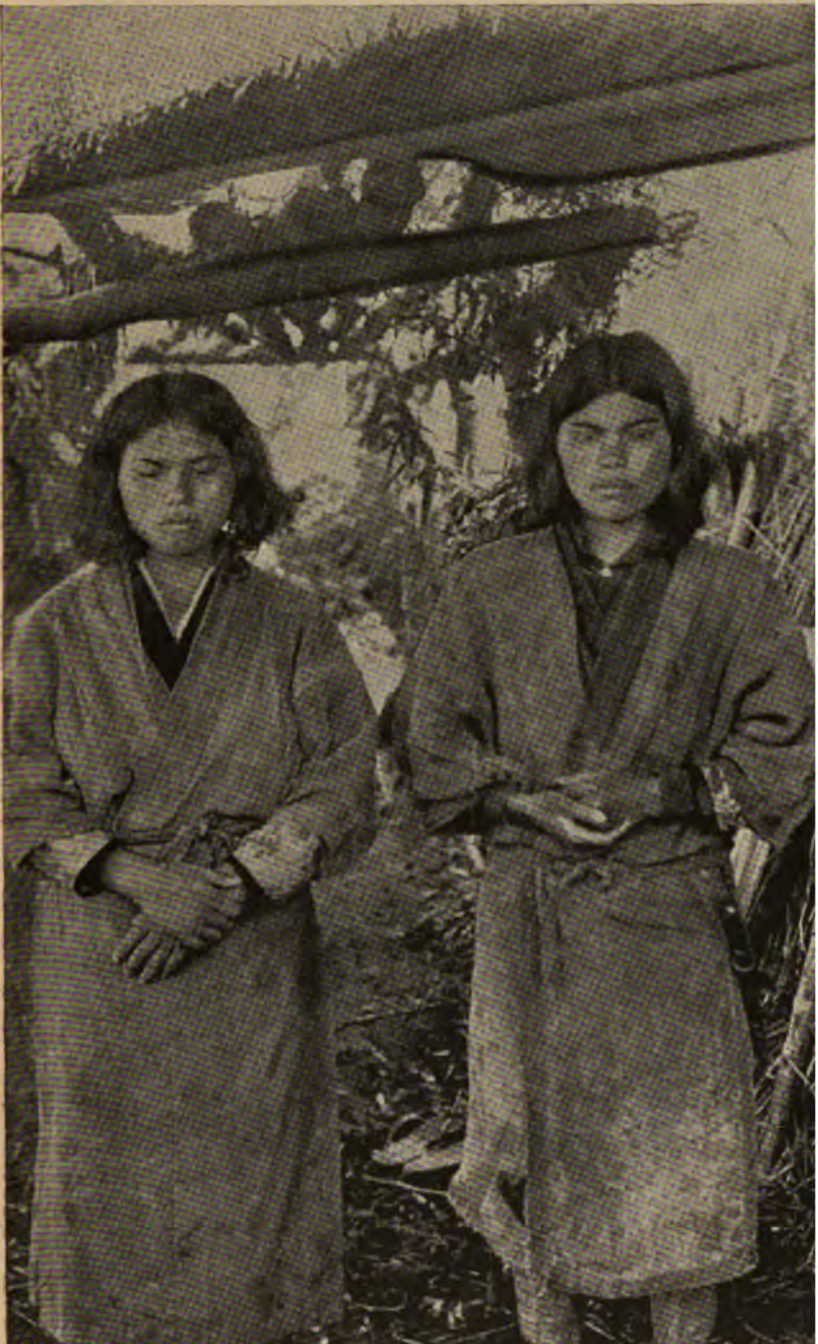
OLD AINO, TOKORO.



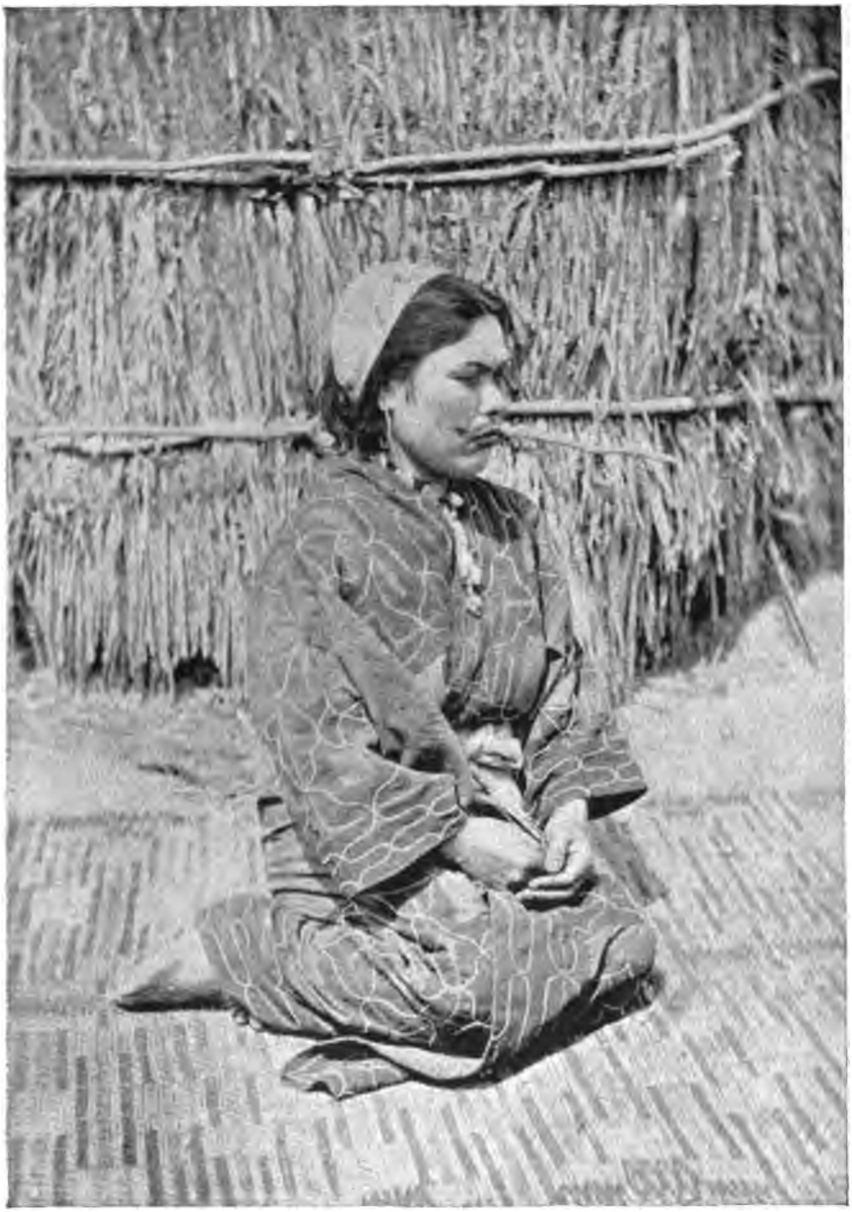
AINO GIRL, URAP.



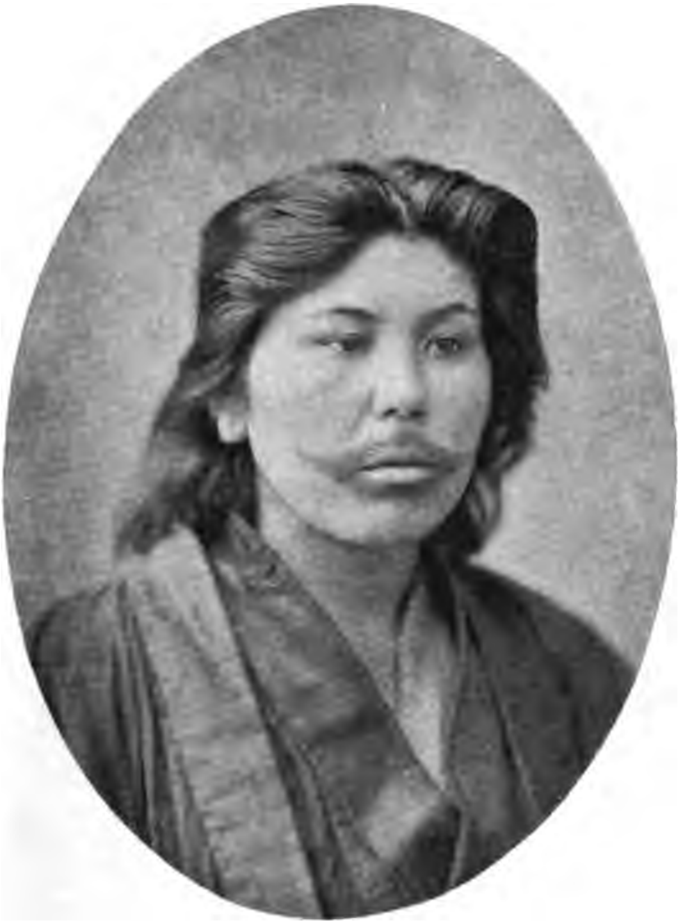
AINO WOMEN, ABASHIRI.



AINO GIRLS, TOKORO.



AINO WOMAN, URAP.



AINO GIRL, URAP.

food and raiment, the wigwam is close and smoky, the fruits of the earth are nuts, and acorns, and roots, and grubs dug out of the ground. To know how miserably a savage lives, one must see him in his house.

A century ago the Ainos were living in the age of stone. They are beyond it now only because they have obtained knives from the Japanese. The stone arrow-heads, which one may pick up almost anywhere, even in the plowed fields of Hakodate, have given way to heads of bamboo or iron. At Yeterof I purchased a stone implement for cutting, which could not have been very old. They have no writings, no records of their past, no aspirations. Their language is still a puzzle, their traditions and myths are scarcely known except to a few students. They are incapable of advancement. After a century of contact with the Japanese, they have learned no arts, adopted no improvements. The hunter to day shoots the bear with poisoned arrow from a bow as primitive as early man himself, although the Japanese are famous for their archery and weapons.

## PHYSICAL CHARACTERS OF THE AINOS.

The appearance and general characteristics of the Ainos have already been described. It is, therefore, only necessary to allude particularly to certain conspicuous features, mainly to their hairy nature. For a good series of physical measurements the reader is referred to those of Dr. Scheube,* and especially to a very valuable contribution by Prof. W. Donitz.† The last-named author concludes that on the whole the results of his observations indicate that the Ainos belong to the Mongolian stock. This conclusion is not sustained by all observers. Dr. Scheube, for example, concludes from the results of measurements of Aino skulls, and from other characters, that they do not belong to the Mongolian type. Their great hairiness, the position of the eyes, the conformation of the nose, the great breadth of the face, etc., are all characters which distinguish them from Mongols.

The most conspicuous feature of the Ainos is their remarkable hairiness. The testimony of travelers concerning this matter is conflicting, but we may explain this on the supposition that the observers have not always recognized the typical Aino. Mr. Batchelor says: "I have seen one old man so completely covered with hair that his body could hardly be seen." This was an exceptional case, but my own observations have fully substantiated the results of those writers who have carefully investigated the physical characters of these people. Dr. Scheube relates that he has seen men with hair on the breast 10 centimetres in length, and on the back 5 centimetres and over. This subject has been examined by Dr. Hilgendorf,‡ who, in 1875, made a series of microscopical investigations. He found that the hair of the head was coarse, slightly curved, and of a pure black color. The hairs are not so numerous over a given area of the head as on Japanese or Europeans. On 1 square centimetre 214 hairs were counted. On a Japanese with rather fine hair he found 286; on another with coarser hair, 252; on a fine-haired German, 280; on another with coarser hair, 272.*

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* Scheube, B. Die Ainos. Mittheilungen der Deutschen Gesellschaft für Natur- und Völkerkunde Ostasiens, III (1882), 220–245.

† Donitz, Prof. W. Bemerkungen ueber Ainos, *loc. cit.*, Dec., 1874, 61–67.

‡ Mitth. Deutschen Gesellsch. für Natur- u. Völkerkunde. June, 1875, pp. 11–13.

Nevertheless, the volume of hair on the Ainos is not small, since this depends both upon the number and the size of the hairs. The Aino hair is oval in section, and the greatest diameter is from 0.1 to 0.125 millimetres. The measurements were made by securing single hairs in a cylinder of wood and by turning this about, measuring the diameters with a microscope. The following measurements are given:

| | | | |
|---|---|---|---|
| Aino No. 1 | One large hair | 0.078 | 0.125 |
| Aino No. 2 | One hair | 0.090 | 0.106 |
| Aino No. 3 | do | 0.085 | 0.127 |
| Aino No. 4 | do | 0.095 | 0.127 |
| | do | 0.093 | 0.138 |
| | do | 0.090 | 0.140 |
| Aino No. 5 | do | 0.087 | 0.106 |
| | do | 0.079 | 0.111 |
| | do | 0.079 | 0.111 |

The flattening is in proportion of 2 to 3. According to the same authority the hair of the upper body is principally about the middle of the breast and on the line below. The breast hairs were 6 millimetres in length, about twenty-four on a square centimetre. They measured 0.106 by 0.069 millimetres in diameter.

In addition to these observations, Mr. John Aspinwall has examined several specimens of hair which I obtained—not without evident misgivings on the part of the people—from the Ainos at Piratori. Mr. Aspinwall's measurements have been numerous, and his results are given here in considerable detail.

### REPORT OF MR. JOHN ASPINWALL.

In accordance with your request, I have made a microscopical examination of the five samples of Aino hair collected by you. Two objects were kept in mind in this examination: First. I wished to obtain a true cross-section; second. To discover the true relation of the plane of natural curvature of the hair to the figure of the cross-section.

To obtain the first, it seemed necessary that no more pressure should be given to the hair than that exerted by the knife of the microtome in cutting. This was accomplished by splitting a cork, placing the hair upon it with its plane of natural curvature parallel to the cut, partially embedding it in a gelatine-glycerine mass, and then laying the other half of the cork gently on the hairs without disturbing them. The cork with the inclosed hairs was immersed in alcohol as soon as the imbedding mass had set, and there allowed to remain until the mass was hardened sufficiently for cutting. The cork here acted as a backing to the imbedding mass while the hairs were held in place for mounting. In clamping in the microtome, care was taken to clamp far enough below the cutting plane to avoid pressure on the hair at the cutting point. In this manner I believe a true cross-section was obtained, as shown in my photographs of the sections.

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* It has been found by Dr. Wilson that the number of hairs per square inch upon the head of a fairly healthy person is 1,066, which gives for the entire head the number 127,920. Some persons have as many as 150,000 hairs on the head.

A different mode of treatment seemed to be necessary to obtain the true relation of the plane of curvature to the form of the cross-section. If sections of the hair were made by the above method, the relation of the curve to the shape of the section would only be obtained at the point of cutting. This would be sufficient if the relation were constant, but if the relation varied in the same hair, it would not be shown by such a method. I therefore resorted to the examination of a single hair in which the natural curve had evidently been preserved. The hair was cut with sharp scissors as nearly at right angles to the axis as possible. The hair being placed in the stage-forceps, the surface of the cut was brought into focus and measured with an eye-piece micrometer. It was cut again, both across the long axis and then across the short axis. Under this treatment the oval sections did not vary sensibly in character, and the lengths of the axes were not affected to any extent by the direction of the cuts. This was done to a number of hairs until I was convinced that the direction of the cut would not perceptibly alter the shape of the section or the direction of the long axis. After this all hairs were cut in one direction, and I think the tables given prove that the mode of cutting gave true results.

It will be seen by the tables that the plane of curvature, in its relation to the longest diameter of the section, as well as the shape of the cross-section itself, varies, in many instances in the same hair, both with man and woman. My observations in this direction were limited to three of the samples of hair sent, because they were the only ones that had been cut off sharp in a lock. The other samples were not in a condition to show the natural curvature. These latter samples I carefully cut with the scissors in three places, viz, at the butt, middle, and end. These faces were carefully measured with the results given in the tables. The scissors seemed to crack the hairs across, leaving a clean surface capable of being accurately measured.

### AINO HAIR.

*Specimen No.* 1.

[Measurements in millimetres made from sections.]

| No. of hair. | Length of long axis. | Length of short axis. | Figure of the cross-section. |
|---|---|---|---|
| 1..... | .113 | .0756 | Oval. |
| 2.... | .1235 | .103 | Do. |
| 3..... | .1063 | .069 | Do. |
| 4..... | .1063 | .0706 | Do. |
| 5..... | .0862 | .0617 | Round (irregular). |
| 6..... | .0894 | .0411 | Oval. |
| 7..... | .079 | .0706 | Round (approximately). |
| 8..... | .0962 | .079 | Oval. |
| 9..... | .1046 | .0723 | Oval (approximately). |
| 10..... | .1063 | .0617 | Oval. |
| 11.... | .0994 | .079 | Do. |
| 12..... | .103 | .0862 | Do. |
| 13..... | .0723 | .0659 | Round (approximately). |
| 14..... | .0756 | .069 | Do. |
| 15..... | .0517 | .0477 | Do. |
| 16..... | .079 | .0583 | Oval. |

Average of long axes ............................. .09698
Average of short axes ............................. .07431
Or nearly related as 1 to 1⅓.

*Specimen marked No. 3. Aino hair from man named Benri.*

[The measurements read downward, *i. e.*, the first is at butt of hair, the second near the middle, and the third near the end. Measurements are in millimetres.]

| No. of hair. | Length of long axis. | Length of short axis. | Color of hair. | Figure of the section. |
|---|---|---|---|---|
| 1... | .1475 | .132 | White.. | Oval. |
| | .168 | .09 | | Do. |
| | .132 | .0955 | | Do. |
| 2... | .132 | .1 | Black..... | Not noted. |
| | .168 | .1 | | |
| | .132 | .0655 | | |
| 3... | .115 | .082 | ...do .... | Oval. |
| | .132 | .1 | | Approximate triangle. |
| | .15 | .05 | | Oval. |
| 4 .. | .082 | .082 | ...do .... | Round. |
| | .1 | .0655 | | Oval. |
| | .082 | .05 | | Do. |
| 5... | .1155 | .115 | White.. | Approximate round. |
| | .168 | .082 | | Approximate oval. |
| | .1685 | .082 | | Oval. |
| 6... | .132 | .1 | ...do .... | Do. |
| | .168 | .1 | | Do. |
| | .1 | .05 | | Do. |
| 7... | .132 | .1 | ...do .... | Do. |
| | .132 | .115 | | Triangle. |
| | .1 | .0655 | | Oval. |
| 8... | .15 | .082 | ...do .... | Do. |
| | .198 | .1 | | Do. |
| | .168 | .115 | | Do. |
| 9... | .1 | .082 | Black... | Approximate oval. |
| | .1 | .082 | | Do. |
| | .115 | .082 | | Do. |
| 10... | .168 | .1 | White.. | Do. |
| | .15 | .115 | | Do. |
| | .1 | .05 | | Do. |
| 11... | .082 | .0655 | Black... | Approximate round. |
| | .115 | .065 | | Oval. |
| | .082 | .03 | | Do. |
| 12... | .082 | .0655 | ...do .... | Do. |
| | .1 | .0655 | | Do. |
| | .1 | .05 | | Do. |
| 13... | .1 | .082 | ...do .... | Approximate oval. |
| | .1 | .082 | | Do. |
| | .1 | .0655 | | Oval. |
| 14... | .1 | .082 | ...do .... | Do. |
| | .115 | .0655 | | Do. |
| | .0655 | .038 | | Do. |
| 15... | .1 | .082 | ...do .... | Approximately round. |
| | .132 | .082 | | Oval. |
| | .082 | .03 | | Do. |
| 16... | .082 | .082 | ...do .... | Approximately round. |
| | .115 | .0655 | | Oval. |
| | .082 | .038 | | Do. |
| 17... | .1 | .09 | ...do .... | Approximately oval. |
| | .1 | .066 | | Oval. |
| | .082 | .032 | | Do. |

*Specimen marked No.* 3. *Aino hair from man named Benri*—Continued.

| No. of hair. | Length of long axis. | Length of short axis. | Color of hair. | Figure of the section. |
|---|---|---|---|---|
| 18... | .1 | .082 | Black... | Oval. |
| | .1 | .0655 | | Do. |
| | .082 | .03 | | Do. |
| 19... | .108 | .082 | White .. | Do. |
| | .15 | .09 | | Do. |
| | .1 | .0655 | | Do. |
| 20... | .115 | .09 | ...do .... | Do. |
| | .168 | .082 | | Do. |
| | .082 | .05 | | Do. |
| 21... | .132 | .09 | ...do .... | Approximately oval. |
| | .183 | .09 | | Oval. |
| | .1 | .0655 | | Do. |

AINO HAIR—MAN.

*Specimen marked No.* 4.

[This specimen was *cut* from the person and no hairs were full length, nor had they a root end. Measurements in millimetres.]

| No. of hair. | Length of long axis. | Length of short axis. | Color of hair. | Figure of cross-section and remarks. |
|---|---|---|---|---|
| 1... | .115 | .09 | Black... | Oval. |
| | .125 | .09 | | Do. |
| | .125 | .09 | | Do. |
| 2... | .125 | .082 | ..do ..... | Do. |
| | .125 | .082 | | Do. |
| | .108 | .082 | | Do. |
| 3... | .14 | .1 | ..do ..... | Egg. |
| | .132 | .09 | | Oval (approx.). |
| | .14 | .09 | | Do. |
| 4... | .115 | .09 | ..do ..... | Do. |
| | .115 | .1 | | Oval. |
| | .125 | .09 | | Do. |
| 5... | .14 | .09 | ..do .... | Do. |
| | .14 | .09 | | Do. |
| | .0735 | .0655 | | Do. |
| 6... | .108 | .09 | ..do ..... | Oval (approx.). |
| | .1 | .082 | | Do. |
| | .108 | .0735 | | Oval. |
| 7... | .09 | .0655 | ...do .... | Do. |
| | .0735 | .0655 | | Do. |
| | .0655 | .038 | | Do. |
| 8... | .14 | .09 | ...do .... | Do. |
| | .14 | .09 | | Oval (approx.). |
| | .183 | .09 | | Oval. |
| 9... | .1 | .0655 | ...do .... | Do. |
| | .09 | .0735 | | Do. |
| | .0735 | .058 | | Do. |
| 10... | .125 | .09 | .. do .... | Do. |
| | .14 | .09 | | Do. |
| | .125 | .1 | | Egg. |

*Specimen marked No. 3. Aino hair from man named Benri.*

[The measurements read downward, *i. e.*, the first is at butt of hair, the second near the middle, and the third near the end. Measurements are in millimetres.]

| No. of hair. | Length of long axis. | Length of short axis. | Color of hair. | Figure of the section. |
|---|---|---|---|---|
| 1... | .1475 | .132 | White.. | Oval. |
| | .168 | .09 | | Do. |
| | .132 | .0955 | | Do. |
| 2... | .132 | .1 | Black..... | Not noted. |
| | .168 | .1 | | |
| | .132 | .0655 | | |
| 3... | .115 | .082 | ...do .... | Oval. |
| | .132 | .1 | | Approximate triangle. |
| | .15 | .05 | | Oval. |
| 4 .. | .082 | .082 | ...do .... | Round. |
| | .1 | .0655 | | Oval. |
| | .082 | .05 | | Do. |
| 5... | .1155 | .115 | White.. | Approximate round. |
| | .168 | .082 | | Approximate oval. |
| | .1685 | .082 | | Oval. |
| 6... | .132 | .1 | ...do .... | Do. |
| | .168 | .1 | | Do. |
| | .1 | .05 | | Do. |
| 7... | .132 | .1 | ...do .... | Do. |
| | .132 | .115 | | Triangle. |
| | .1 | .0655 | | Oval. |
| 8... | .15 | .082 | ...do .... | Do. |
| | .198 | .1 | | Do. |
| | .168 | .115 | | Do. |
| 9... | .1 | .082 | Black... | Approximate oval. |
| | .1 | .082 | | Do. |
| | .115 | .082 | | Do. |
| 10... | .168 | .1 | White.. | Do. |
| | .15 | .115 | | Do. |
| | .1 | .05 | | Do. |
| 11... | .082 | .0655 | Black... | Approximate round. |
| | .115 | .065 | | Oval. |
| | .082 | .03 | | Do. |
| 12... | .082 | .0655 | ...do .... | Do. |
| | .1 | .0655 | | Do. |
| | .1 | .05 | | Do. |
| 13... | .1 | .082 | ...do .... | Approximate oval. |
| | .1 | .082 | | Do. |
| | .1 | .0655 | | Oval. |
| 14... | .1 | .082 | ...do .... | Do. |
| | .115 | .0655 | | Do. |
| | .0655 | .038 | | Do. |
| 15... | .1 | .082 | ...do .... | Approximately round. |
| | .132 | .082 | | Oval. |
| | .082 | .03 | | Do. |
| 16... | .082 | .082 | ...do .... | Approximately round. |
| | .115 | .0655 | | Oval. |
| | .082 | .038 | | Do. |
| 17... | .1 | .09 | ...do .... | Approximately oval. |
| | .1 | .066 | | Oval. |
| | .082 | .032 | | Do. |

*Specimen marked No.* 3. *Aino hair from man named Benri*—Continued.

| No. of hair. | Length of long axis. | Length of short axis. | Color of hair. | Figure of the section. |
|---|---|---|---|---|
| 18... | .1 | .082 | Black... | Oval. |
| | .1 | .0655 | | Do. |
| | .082 | .03 | | Do. |
| 19... | .108 | .082 | White .. | Do. |
| | .15 | .09 | | Do. |
| | .1 | .0655 | | Do. |
| 20.. | .115 | .09 | ...do .... | Do. |
| | .168 | .082 | | Do. |
| | .082 | .05 | | Do. |
| 21... | .132 | .09 | ...do .... | Approximately oval. |
| | .183 | .09 | | Oval. |
| | .1 | .0655 | | Do. |

## AINO HAIR—MAN.

*Specimen marked No.* 4.

[This specimen was *cut* from the person and no hairs were full length, nor had they a root end. Measurements in millimetres.]

| No. of hair. | Length of long axis. | Length of short axis. | Color of hair. | Figure of cross-section and remarks. |
|---|---|---|---|---|
| 1... | .115 | .09 | Black... | Oval. |
| | .125 | .09 | | Do. |
| | .125 | .09 | | Do. |
| 2... | .125 | .082 | ..do ..... | Do. |
| | .125 | .082 | | Do. |
| | .108 | .082 | | Do. |
| 3... | .14 | .1 | ..do ..... | Egg. |
| | .132 | .09 | | Oval (approx.). |
| | .14 | .09 | | Do. |
| 4... | .115 | .09 | ..do ..... | Do. |
| | .115 | .1 | | Oval. |
| | .125 | .09 | | Do. |
| 5... | .14 | .09 | ..do ..... | Do. |
| | .14 | .09 | | Do. |
| | .0735 | .0655 | | Do. |
| 6... | .108 | .09 | ..do ..... | Oval (approx.). |
| | .1 | .082 | | Do. |
| | .108 | .0735 | | Oval. |
| 7... | .09 | .0655 | ...do .... | Do. |
| | .0735 | .0655 | | Do. |
| | .0655 | .038 | | Do. |
| 8... | .14 | .09 | ...do .... | Do. |
| | .14 | .09 | | Oval (approx.). |
| | .183 | .09 | | Oval. |
| 9... | .1 | .0655 | ...do .... | Do. |
| | .09 | .0735 | | Do. |
| | .0735 | .058 | | Do. |
| 10... | .125 | .09 | .. do .... | Do. |
| | .14 | .09 | | Do. |
| | .125 | .1 | | Egg. |

### AINO HAIR.—WOMAN.

### *Specimen marked No.* 5.

[These hairs were full length, with root attached. Measurements in millimetres.]

| No. of hair. | Length of long axis. | Length of short axis. | Color of hair. | Figure of cross-section. |
|---|---|---|---|---|
| 1... | .108 | .09 | Black... | Oval. |
| | .108 | .082 | | Do |
| | .108 | .09 | | Do. |
| | | | | Do. |
| 2... | .108 | .082 | ...do .... | Do. |
| | .108 | .09 | | Do. |
| | .125 | .09 | | Do. |
| | | | | Do. |
| 3.. | .1 | .09 | .. do .... | Do. |
| | .108 | .09 | | Do. |
| | .108 | .09 | | Do. |
| | | | | Do. |
| 4 . | .108 | .09 | ...do .... | Do. |
| | .108 | .09 | | Do. |
| | .108 | .09 | | Do. |
| | | | | Do. |
| 5... | .108 | .09 | ...do .... | Do. |
| | .125 | .0735 | | Do. |
| | .09 | .058 | | Do. |
| | | | | Do. |
| 6... | .09 | .082 | ...do .... | Do. |
| | .108 | .082 | | Do. |
| | .09 | .082 | | Do. |
| | | | | Do. |
| 7... | .09 | .09 | ...do .... | Round (approx.). |
| | .108 | .09 | | Oval. |
| | .09 | .09 | | Round (approx.). |
| 8... | .125 | .082 | ...do .... | Oval. |
| | .115 | .09 | | Do. |
| | .082 | .058 | | Do. |
| 9... | .108 | .0735 | ...do .... | Do. |
| | .108 | .0735 | | Do. |
| | .108 | .09 | | Egg. |
| 10... | .108 | .09 | ..do .... | Oval.* |
| | .108 | .082 | | Do. |
| | .108 | .09 | | Do. |

* Note that this hair is of same dimension as No. 1 in this specimen.

### AINO HAIR—SPECIMEN NO 1.

*Table showing relation of plane of natural curvature to the axes of the cross-section.*

| No. of hair. | Ratio of length of long axis to that of short axis. | Direction of plane of natural curvature. | Remarks. |
|---|---|---|---|
| 1..... | 4 to 2½ ........... | Short axis ............... | Oval section. |
| 2..... | 7 to 5 ............... | ....do .................... | Do. |
| 3..... | 8 to 4 ............... | ....do .................... | Do. |
| 4..... | 3 to 2¼ ............. | ....do .................... | Do. |
| 5..... | 7 to 4½ ............. | Long axis at outer end, short axis at other. | Large, stiff, well curved hair, oval. |
| 6..... | 4 to 3 ..........<br>3 to 2½ ......... | At butt, short axis; at end, same. | Oval section. |
| 7..... | Not noted ........ | Butt, midway; end, long axis. | Do. |
| 8..... | ....do ........... | Butt, midway; end, short axis. | Do. |

AINO HAIR—SPECMEN NO. 1—Continued.

*Table showing relation of plane of natural curvature to the axes of the cross-section*—Cont'd.

| No. of hair. | Ratio of length of long axis to that of short axis. | Direction of plane of natural curvature. | Remarks. |
|---|---|---|---|
| 9..... | Not noted........ | Butt, long axis; end, midway. | Oval section. |
| 10..... | 5 to 3 ............. | Butt, short axis; end, short axis. | Do. |
| 11..... | 4 to 2 ............. | Butt, long axis; end, short axis. | Do. |
| 12 | Butt 3½ by 2¾, end 4½ by 2½. | Butt, short axis; end, long axis. | Do. |
| 13 | 4 by 2¼...... .... | Butt, midway; end, long axis. | Do. |

SPECIMEN NO. 2.

| | | | |
|---|---|---|---|
| 1 | 7 to 4 ............. | Short axis .............. | Oval section. |
| 2 | 8 to 5½ ............ | ...do .................... | Do. |
| 3 | 9 to 4½ ............ | ....do .................... | Do. |
| 4 | 6½ to 4 ............ | Long axis................ | Do. |
| 5 | 7 to 5 ............. | Short axis .............. | Do. |
| 6 | 8 to 5 ............. | Long axis................ | Do. |

NOTE.—The table readily shows that the relation of the plane of natural curvature to either one of the axes of the cross-section, varies in different hairs, as well as at different points in the same hair.

AVERAGE OF ALL MEASUREMENTS MADE.

[Measurements in millimetres.]

| No. of specimen. | Average of measurements at root end. | | Average of measurements at middle. | | Average of measurements at end. | | No. of hairs measured. |
|---|---|---|---|---|---|---|---|
| | Long diameter. | Short diameter. | Long diameter. | Short diameter. | Long diameter. | Short diameter. | |
| 3............ | .114 | .0937 | .136 | .0946 | .105 | .0571 | 21 |
| 4............ | .1198 | .0853 | .12 | .0853 | .11265 | .0777 | 10 |
| 5............ | .1053 | .0859 | .1104 | .0841 | .1018 | .0828 | 10 |
| Average.. | .113 | .0883 | .1221 | .088 | .1064 | .0725 | 41 |
| Average of all measurements of long diameter........................................ | | | | | | | .1138 |
| Average of all measurements of short diameter ........................................ | | | | | | | .0827 |
| Nearly related as 1 to 1⅜. | | | | | | | |

Figures of the various sections: Oval, 95 sections; approximate oval, 14; round, 1; approximate round, 6; egg, 2; triangular, 1; approximate triangular, 1.

NOTE.—The same hair sometimes represented different figures at the three points where sections were made; for instance, hair No. 5, of specimen No. 3, was approximately round at butt, irregular oval in middle, and oval at the end. It may be noted that in specimen No. 3 we have the greatest average length for the long axes and the shortest average length for the short axis of the figures of the cross-section. Also note the evenness of the average length of short axes of specimens No. 4 and No. 5, the variations being but .0082 millimetres while the long axes varied .0181 millimetres in the same specimens.

A few specimens of Aino hairs from the head were handed to Dr. W. M. Gray, of the Army Medical Museum, Washington, who has also been good enough to prepare a series of cross-sections with his usual skill. From these he made some excellent photographs, which Mr. Chandlee has carefully traced in outline with the result shown in Fig. 70. The original photographs showed the hairs magnified 25 and 300 diameters, respectively, but the outlines have been reduced one-half in the cut.

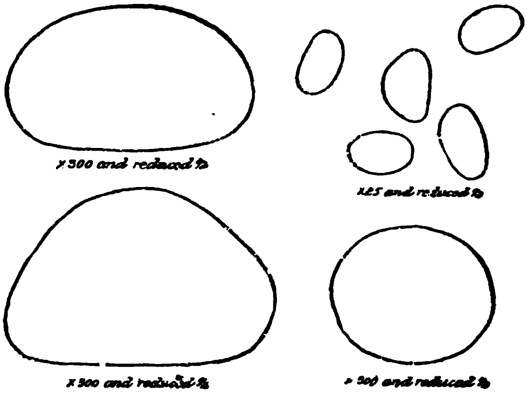


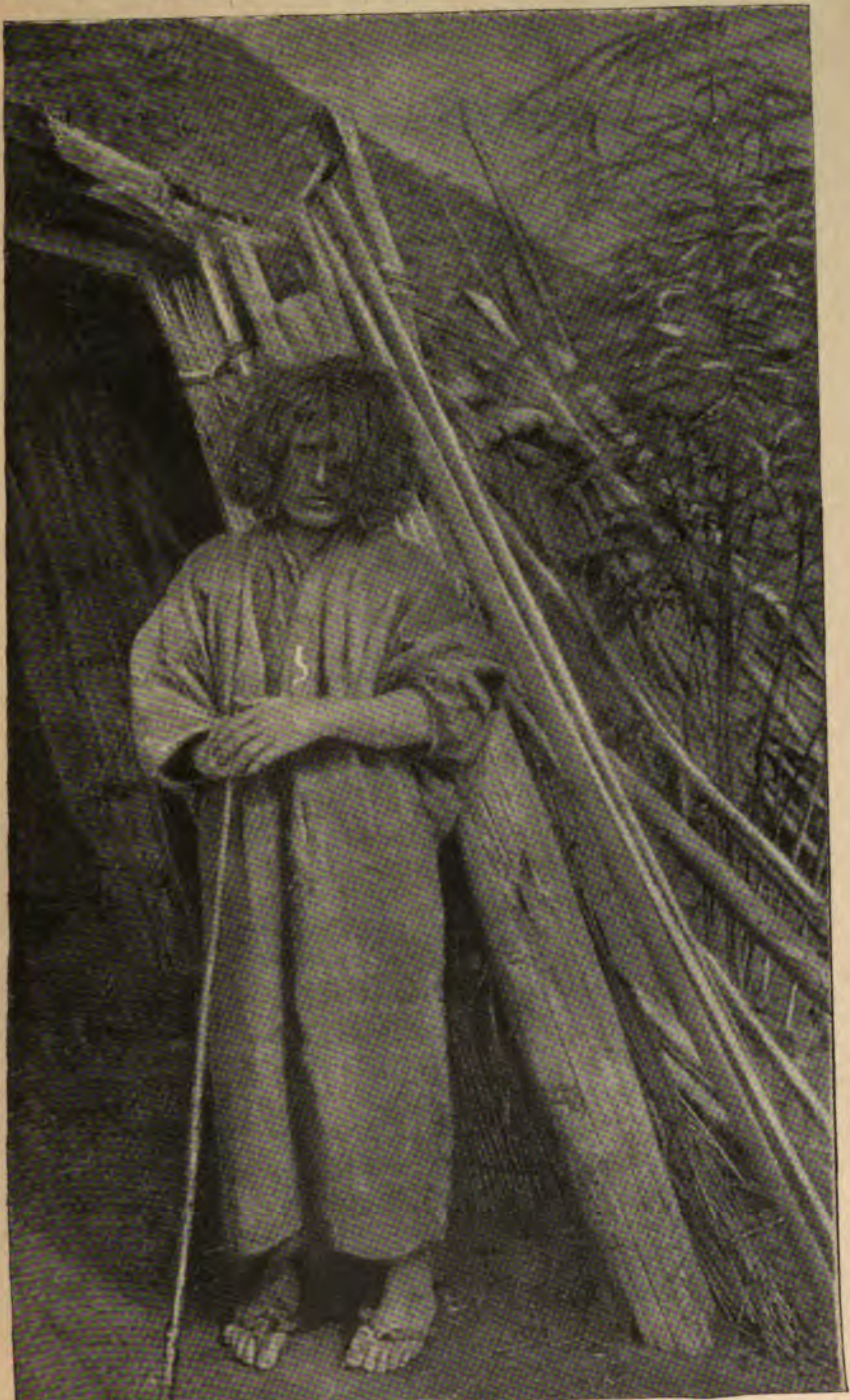
Fig. 70.

OUTLINES OF CROSS-SECTIONS OF AINO HAIRS.

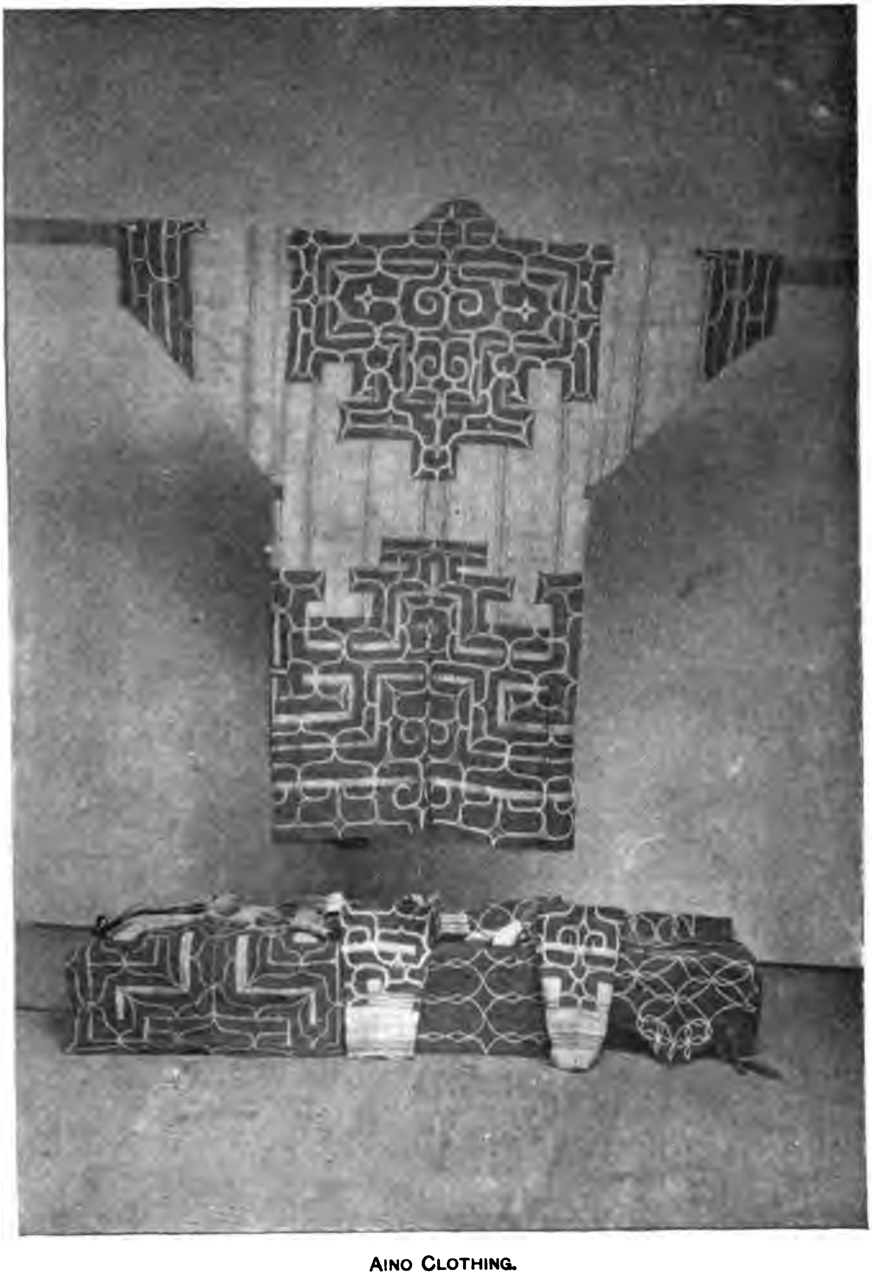
(From photographs.)

This conspicuous hairiness of the Ainos, in strong contrast to the smooth bodies and faces of the Japanese, has led to the natural inquiry: how is it possible that the Ainos should have so long occupied Japan without having left some evidence of an admixture of this character with the Japanese? In the first place, the Japanese are not all alike. Not only do we clearly recognize two distinct types among them, distinguishing the upper or ruling and the lower or laboring classes, but there is also a southern type in Kiushiu, with more or less hair on the face, many having full beards. It is worthy of remark, in passing, that these men have always been, and still are, among the ablest and most influential men in Japan. Professor Chamberlain has observed that the Japanese in northern Japan and in Yezo, where there would naturally be found the greatest admixture of blood, are no more hairy than those farther south. The explanation of this he finds in the fact that the half-castes die out. Such families end with the third or fourth generation, and the progeny show a marked tendency to baldness. The children of Japanese and Aino parents are never vigorous and healthy.

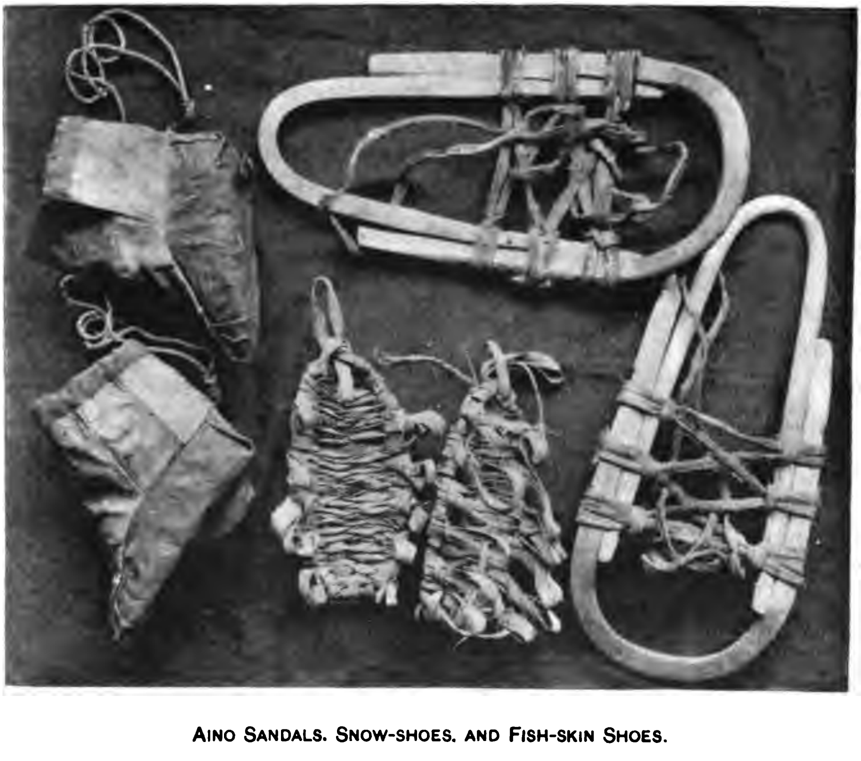
I have a photograph in my collection of a young man with a distinctly Japanese physiognomy, whose body and face are as smooth and free from hair as the Japanese, but whose lower limbs are black with hair.



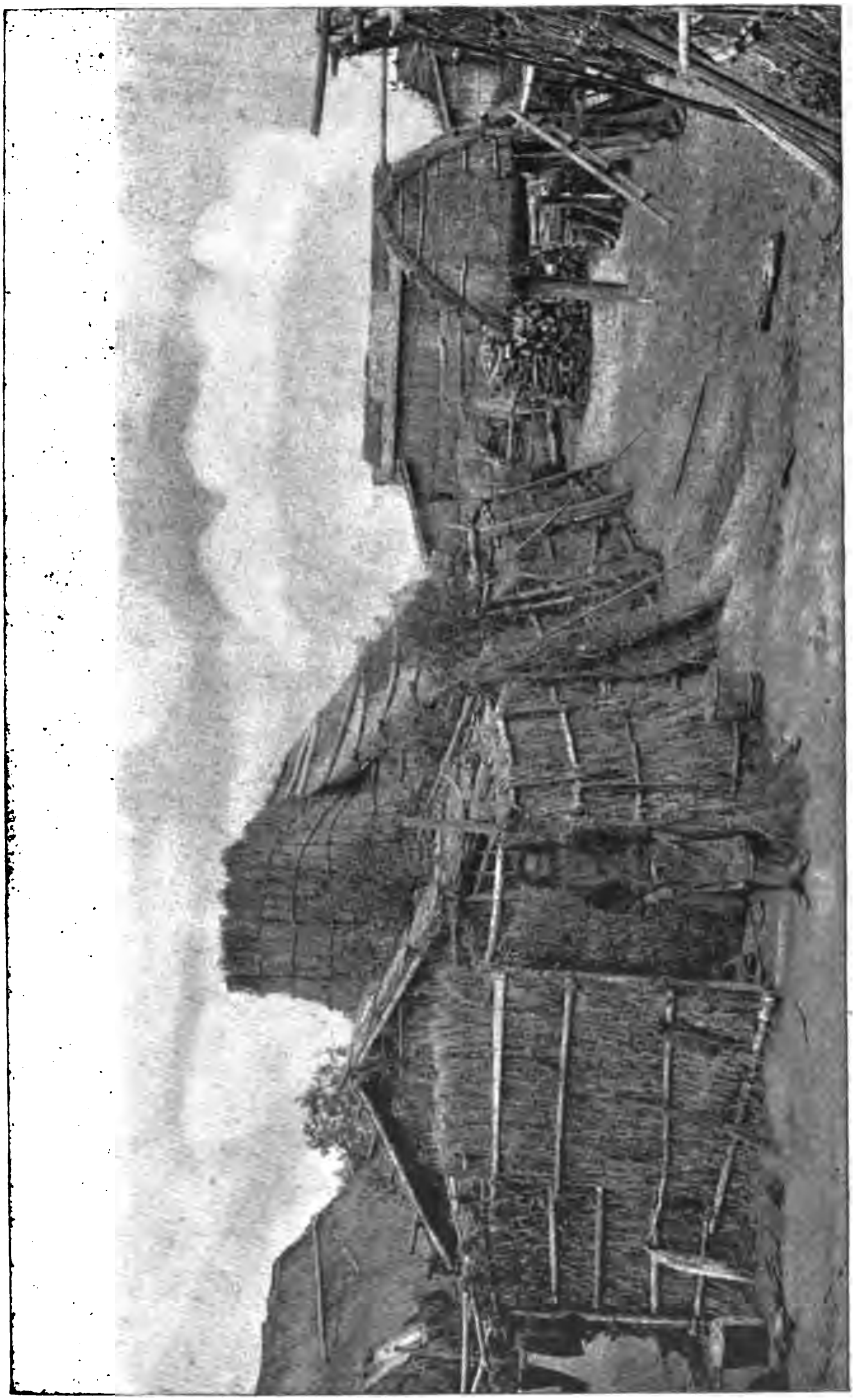
OLD WOMAN, TOKORO.



AINO CLOTHING.

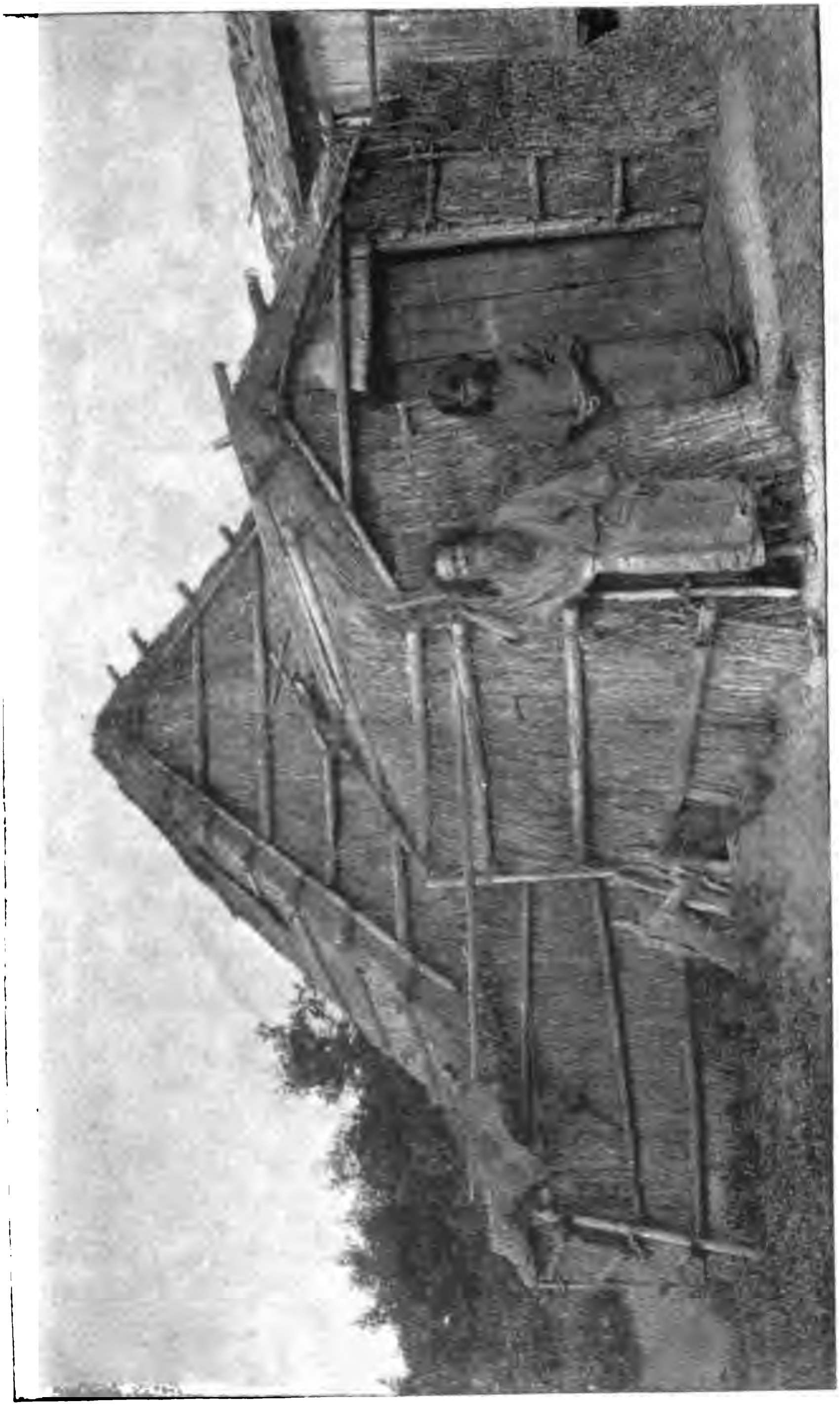


AINO SANDALS. SNOW-SHOES. AND FISH-SKIN SHOES.

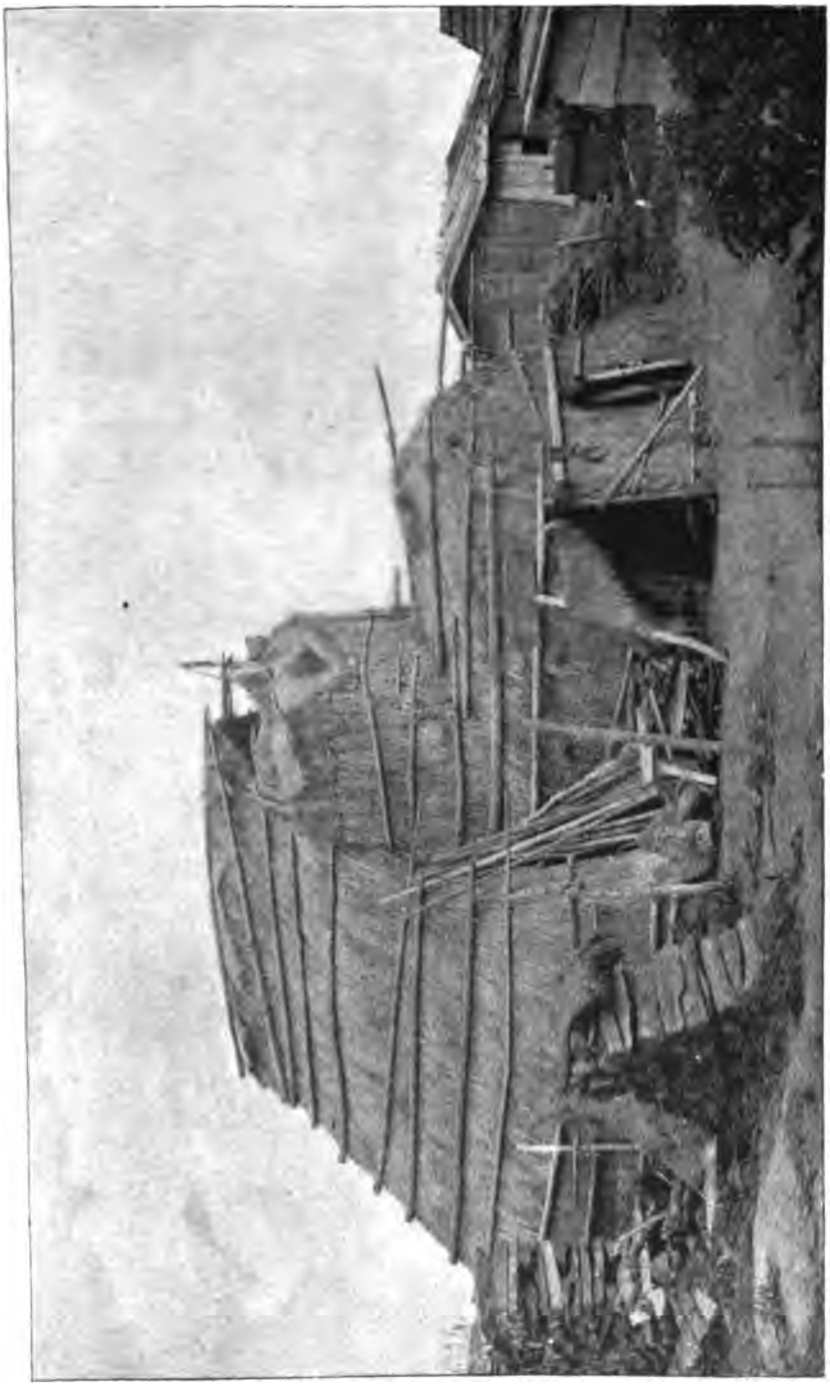


AINO HOUSE AND STORE-HOUSE, SHARI.

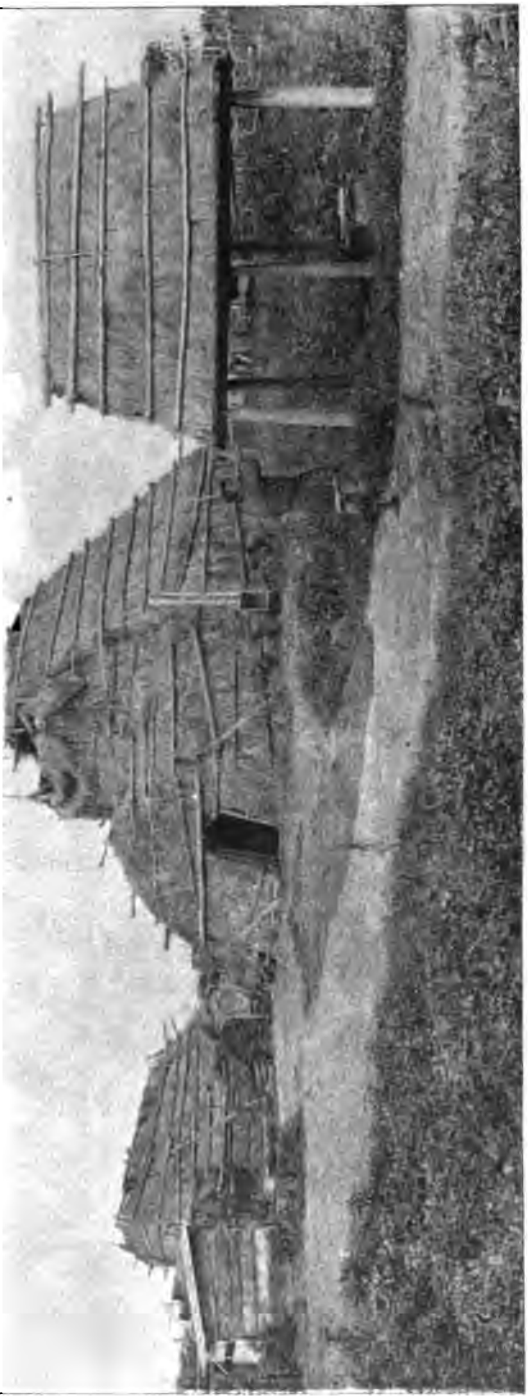
PLATE XCIX.



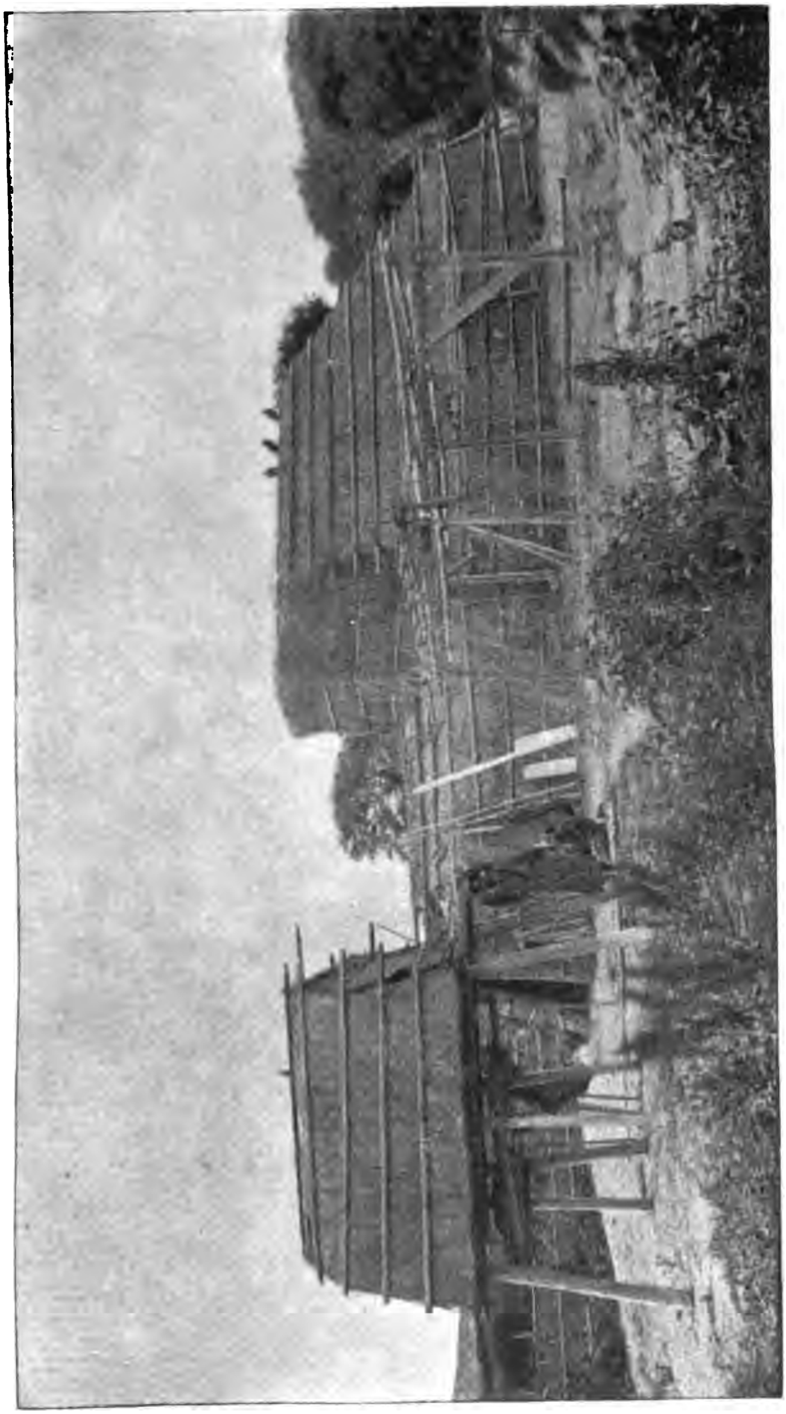
AINO HOUSE, SHARI.



AINO HOUSE AND SIDE TENT, BITSKAI.



AINO HOUSE AND STORE-HOUSE, BITSKAI.



AINO HOUSE AND STORE-HOUSE, SHARI.

## CLOTHING.

The Ainos weave a very durable, coarse kind of cloth from the fibrous bark of the mountain elm, *Ulmus montana*, known as the *ohiyo*. Mr. Blackiston has pointed out that the species *Ulmus campestris* (Japanese *akadamo*) is also used.

The principal garment is a coat made of this material. It is patterned after one form of the Japanese coat. The shape is well shown in Plate XCVI, which represents the back of an embroidered coat made of the *ohiyo*, with strips of blue Japanese cotton cloth sewed on, and a running design of white braid, also produced in Japan. Such elaborate decoration is only applied to the best garments, those for common wear being quite plain. Japanese cotton goods are replacing the *ohiyo*. Already the native cloth is far less common than it has been, and while I was in Yezo I found it by no means abundant. The native looms will soon be out of use, for cotton goods, although less durable than the *ohiyo*, are warmer and softer. A narrow belt is worn around the waist. The women usually wear an under-garment of cotton, and occasionally an apron.

Leggins are worn by both sexes. These are very simply made, but are also often decorated with braid.

Sandals are worn in the summer (Pl. XCVII). These are said to be made of *kurumi no kawa*, walnut bark. The winter clothing is made of the skins of animals. For traveling in the snow there are shoes made of fish skin, and wide snow-shoes consisting of wooden frames with thongs of bear-skin, both of which are represented in this plate.

## DWELLINGS.

The typical Aino house is a square or rectangular main structure, ually entered through a low gable-roofed passage-way. The framework is made of rough beams put together in the manner shown in Fig. 71, which is a drawing made from a photograph taken at Tokoro. The houses are thatched with reeds, usually the *Imperata arundinacea* Cyrill, held down by poles. Such a house is shown in Plate XCVIII, at Shari. There is a small opening just below the apex of the roof in front, through which the smoke escapes, and in cold weather this is the only outlet for the smoke. A sliding board-shutter in the middle affords ventilation through the roof, but this is closed in the winter. Houses of this kind are common in the north, where the winters are very cold. Farther south there is no opening through the roof, and the smoke passes out through a large triangular opening in front beneath the ridge-pole. To prevent wind and rain from beating in, a rectangular sort of chimney is built in front of the aperture. A similar house, also at Shari, is shown in Plate XCIX. A similar house at Bekkai or Bitskai, near Nemuro, is shown in Plates C and CI, which are two views of the same house. This house is thatched with straw. In Plate CII, back of the wood pile, there is a small, tent-like structure made of poles covered with Japanese straw mats. There are several such tents in the village, and on venturing to peep into them, much to the evident distaste of the natives, I found them to be inhabited. They are scarcely large enough for a human being to crawl into, but it would appear that the aged women of the village sleep in them and have dogs for companions. They crawl in somehow, curl up among filthy rags and tattered coverings, and smother themselves to keep warm.

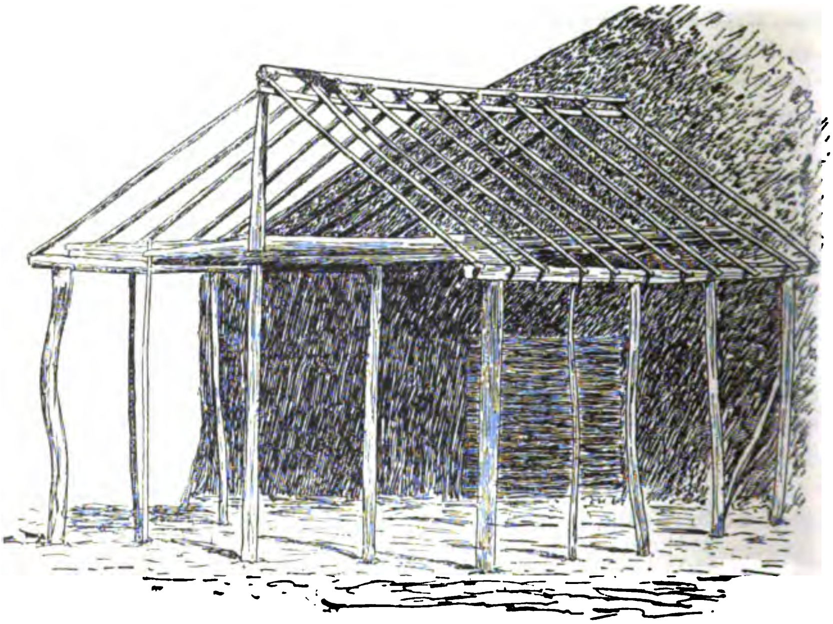


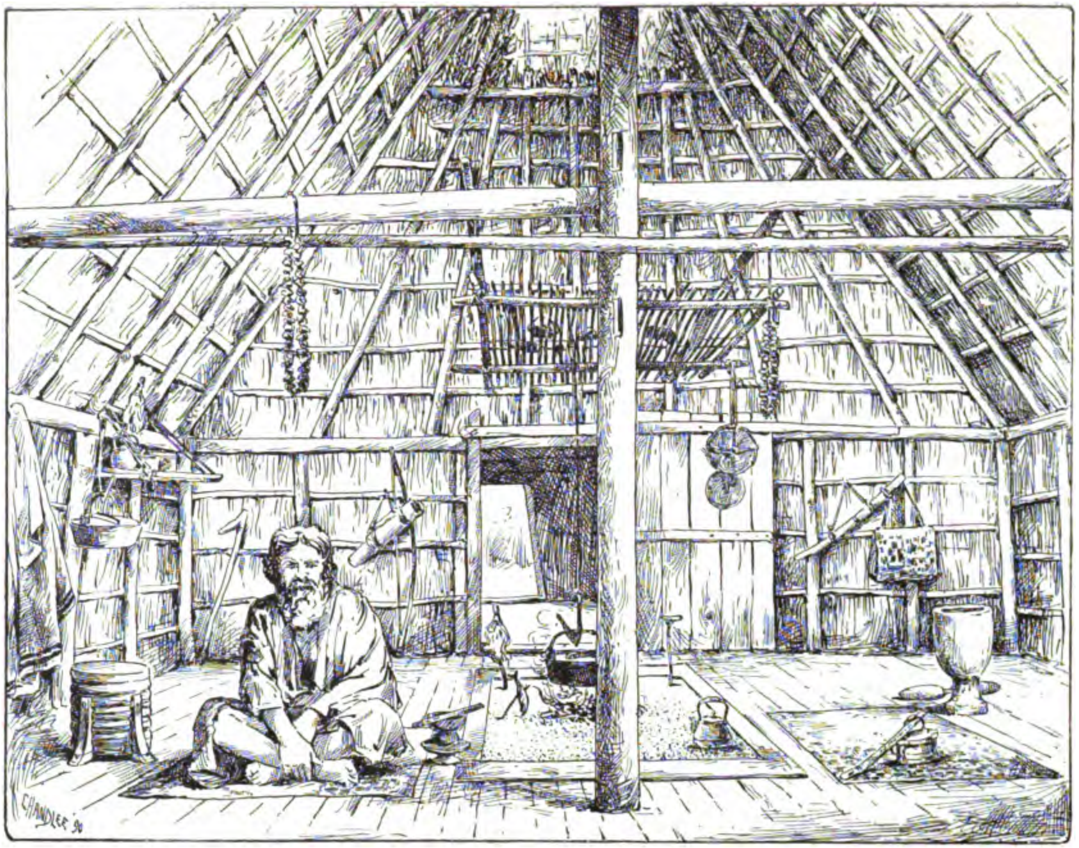
Fig. 71.

FRAME-WORK OF FRONT PART OF AN AINO HOUSE.

(From a photograph.)

The interior of a house at Bekkai, taken from a photograph made with magnesium light, is shown in Plate CIII. The camera was set up in the back window of the house. The main room is well shown, and the outside scenery is glimpsed through the long entrance passage-way.

Entering this house from the front, one must stoop to pass through the doorway which will perhaps have only a mat of straw or reeds to close it. The rectangular passage is used as a storeroom. It is high enough for one to stand in erect. The floor is the damp earth. At the back is a sliding door made of boards, inclining outward toward the bottom, through which, by stooping low, the main room about 18 by 20 feet square is entered. The door is 3 feet in width by 3½ in height. Just inside the door is a space, 3½ feet by 9 feet, where the sandals are left on the bare ground. The floor of this house is made of boards raised about 9 inches above the ground, but they are covered with dirt. A visitor receives a clean mat, which is immediately spread on the



INTERIOR OF HOUSE, BITSKAI.

floor for his accommodation. The fireplace, situated about in the middle of the room, is a rectangular depression about 5 feet by 3, filled with ashes, on which a smoky fire of green wood fitfully lights the gloomy interior. An iron pot, of Japanese manufacture, is suspended above the fire, in which food is almost constantly cooking. One or more *inao*, or god-sticks, usually stand upright in the ashes. There is usually a sort of latticed shelf suspended at some distance from the fire, on which fish are dried and smoked and strings of roots or other vegetable products hang in festoons preserved for winter food. A rectangular window at the back of the house admits all the light, except such as makes its way in through the chimney. The interior is therefore always gloomy. The beams and rafters are covered with a thick coating of shiny, black soot, which slowly accumulates upon them from the fire. Even in summer the atmosphere within these houses is often so full of smoke as to make one's eyes water. At night a large, flat mussel-shell, *Pecten Japonicus*, supported on a three-forked stick standing upright in the ashes, with a wick and fish oil, gives a faint light, and it is a weird sight indeed to see these dark-visaged, kindly savages grouped around the smouldering embers.

At this village, Bekkai, or as the name was also pronounced, Bitskai, about 12 miles from Nemuro, there are six houses of this character. The Aino population is given as 56 persons, living in 14 houses, but many of the other houses are built more like Japanese houses of a very inferior kind. From my observations I should say that there can not be so many Ainos in the village. Many of the Japanese have Aino wives. It is possible that there are one or two pure Aino families there, but I doubt it.

All the houses at Bekkai front toward the east, or easterly. The back window, therefore, faces the west. This is a fact worthy of particular notice, as it has been repeatedly asserted that all the Aino houses face the south. The houses at Piratori are mostly built east and west, without any door at the end. There is an entrance to the main room on the south side, and also an entrance to the hall or entrance passage on the south side. In the houses at Piratori there is a window on the east side. Numerous *inao* are hung on strings along the wall near one corner. One might readily suppose, from the writings of different authors, that there is some great significance in the fact that the houses in southern Yezo are built with their lengths east and west, and in the position of the east window. But I doubt if there is any more meaning in it than that a southern exposure is desirable in a cold northern land, and that the morning sun streams in through the east window. It is, indeed, possible that the latter is a place of worship; but I have not found that the huts are built in this direction throughout Yezo. They do not always have east windows. The house shown in Plate C, for example, has only a west window. The same may be said of the custom of placing the treasures in the northeast corner, mentioned by

Scheube, Batchelor, and others. I am inclined to regard this as purely a matter of convenience or habit. Mr. Batchelor should be able to tell us whether the Ainos consider the points of the compass in these matters. I would only point out that what he and others have told us concerning the dwellings of the Ainos in the south, does not hold for those living on the northeast coast.

The houses represented in Plates XCVIII to CIII are typical Aino houses. This statement is made with entire confidence, as the result of extended travel through the country. On some parts of the island the thatch is put on with more care, as at Uragawa, for example, where the reeds are in overlapping layers, or, as Dr. Scheube says of the houses near Horobetsu, the only region of importance for Aino studies that I did not visit, of reeds laid on in a terrace-like manner.

The house figured by Dr. Scheube is by no means a usual form, although probably it does prevail in that part of the island where he visited the Ainos, around Volcano Bay, for he says: "The houses only differ one from another in size." Of these houses Dr. Scheube says that their length runs east and west. With exception of the west side, there is a window on each side, which may be closed with a reed mat. I am not prepared to maintain that the Ainos have no regard to the points of the compass in setting up the sacred relics, symbols, *inao*, etc., in particular parts of their houses, but I doubt very much if they do have. As already stated, Dr. Scheube and other writers tell us that the household treasures are kept in the northeast corner. But so far as I have been able to discover, no writer has given a reason for these customs, although they all leave one to infer that they are general and invariable.

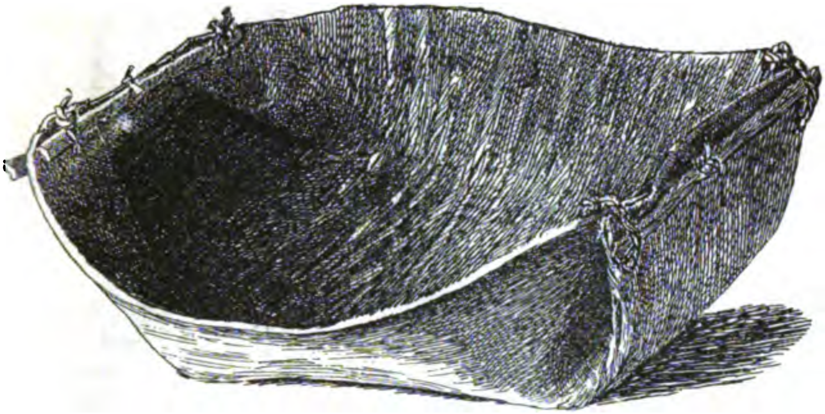
## STOREHOUSES.

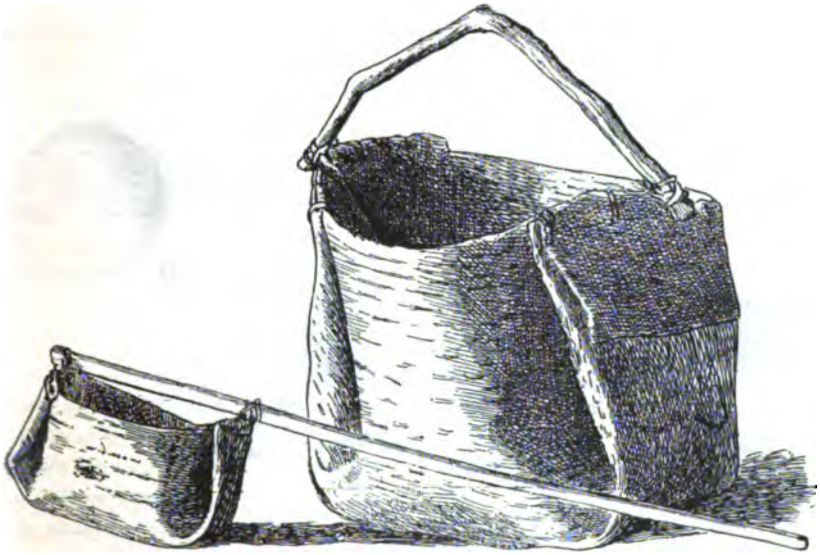
The Aino storehouses are very much alike throughout the island. They are shown in Plates XCVIII, CI and CII and require no particular description. They are raised on posts about 6 feet above the ground to be secure from the attacks of wild animals. They are filled with dried fish, vegetables, and other articles of food.

## HOUSEHOLD UTENSILS AND FOOD.

Doubtless there was a time, not very long ago, when the Ainos ate with their fingers and had no better dishes for their food than such as they still make of bark. Fig. 72 represents a large dish made of bark, such as are in common use. The one numbered 150673 is 14 inches in length by 13 inches wide, and is used for fish. But precisely the same kind of dishes are made much smaller—not more than 4 inches long. The common water-bucket and dipper are also made of bark, as shown in Fig. 73 [150668]. They have since learned to use Japanese knives, however, and they make a variety of wooden plates, which they decorate with characteristic carved patterns (Fig. 74). Wooden spoons

(Fig. 75) are now in universal use, of which there is a variety in the collection, and for eating they have a flat, spatula-like instrument (Fig. 75), which they use in addition to chopsticks. The knives, or rather the knife-cases, in common use are represented in Fig. 76, which shows very well the characteristic style of wood carving. The knife-blades are of the ordinary Japanese form, but the Ainos make the wooden handles and sheathes, which are usually decorated with carving. The knife is carried sticking in the girdle. One specimen in the figure, numbered 150729, has a sheath of wood and bone.


150673
Fig. 72.
BARK DISH USED AS A FISH-PLATE.


150668.
Fig. 73.
BARK WATER BUCKET AND DIPPER.

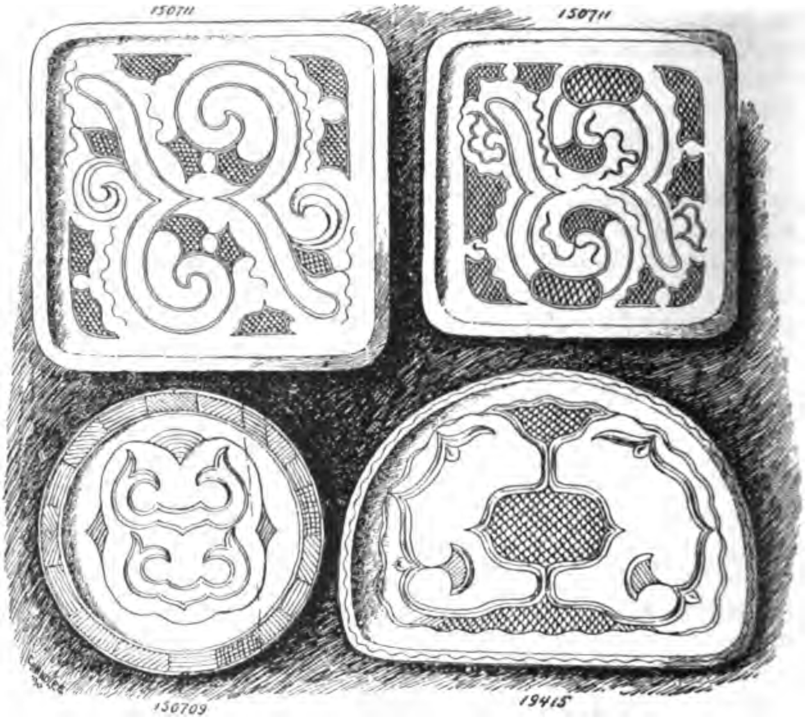


Fig. 74.
CARVED WOODEN PLATES.

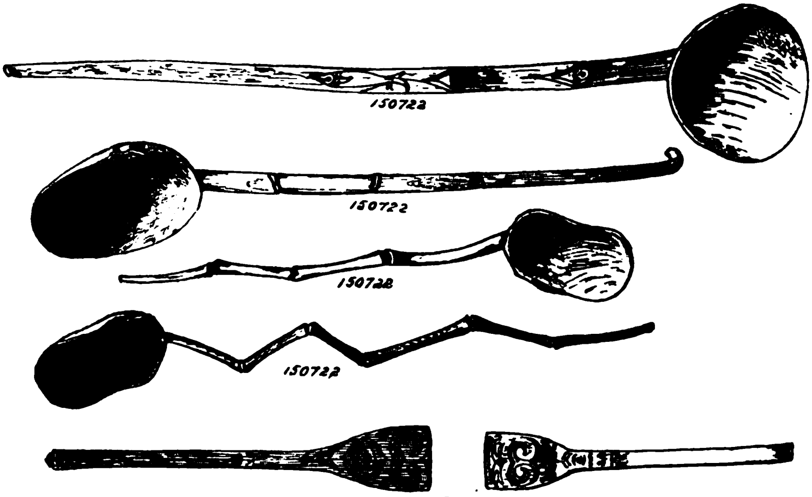


Fig. 75.
WOODEN SPOONS AND CARVED SPATULAS USED IN EATING.

Rice being an article easily obtained from the Japanese, the Ainos make oblong rice bowls by digging out thick pieces of wood. These differ somewhat in form in different parts of the island. (See Fig. 69, p. 441.)

For preparing grain, such as millet, which is cultivated here and there, they have a wooden mortar and pestle, the former standing perhaps 2 feet high, and made of a solid block of wood.

In every Aino house there may be found some treasured articles made by the Japanese. Sometimes these articles are very old, having been handed down from father to son, and they are then valued as precious relics. Of these, Japanese swords are most highly prized, after which come lacquered cups (Fig. 77), which they use for drinking. The latter, together with other small articles, are kept in Japanese round, lacquered cases, one or more of which are to be seen in every house.

A considerable variety of animal food is to be obtained in Yezo, for the Ainos are good hunters with their rude bows and arrows.

The bear is much sought after for its flesh, as well as for its skin, which is used for clothing; and set-bows are arranged in the woods with poisoned arrows, which are released when a bear comes in contact with a cord in his path. The fox and wolf also abound, the former being caught in an ingenious bow-trap. At some seasons fresh fish abound, and they dry and half smoke great quantities of it for winter use. In the National Museum there is a specimen of salmon cut into

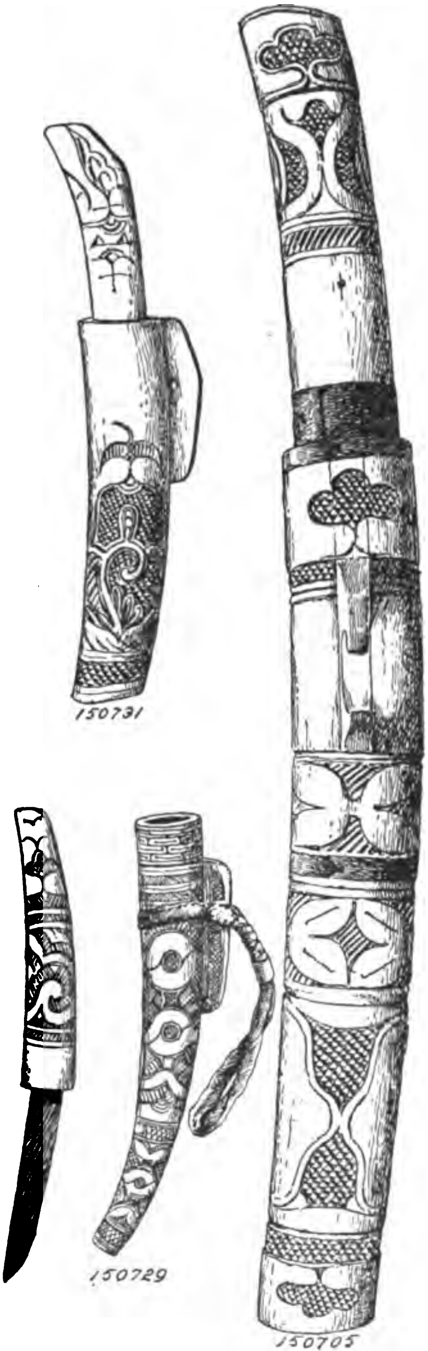


Fig. 76.
Carved Knife-cases.

strips 40 inches in length and dried. Dried herrings are abundant in every house, but they are not pleasing to the eye. The roe of the salmon, *masu*, is also dried and much prized by the people..

For vegetable food they depend partly upon the produce of small patches of ground, which they cultivate in a rather careless manner, and partly upon the natural products of the soil. A preparation known as *shikeribikina* is the dried leaves of some plant unknown to me, which they find on the mountains. Lily roots dried on strings are found in every house. At Abashiri I found strings of small fruit, which the Ainos called *maou*. These fruits belong to the genus *Rosa*, and the Ainos eat them both green and dried. Flat, circular cakes of dried lily roots, with a hole through the center, are tied together with bark, but I was unable to get a translation of the name they bear, which is, as I understood the word, *umbayero*. At Abashiri I found some very good flour, but its source could not be learned. Numerous other varieties of food are to be seen in the collection.

Cooking is carried on in an iron kettle with a wooden cover, over the fire-place. Every imaginable edible substance that they possess goes into the indescribable stew—fish, vegetable tops and roots, flesh and fowl, altogether—to be either ladled out with wooden spoons or fished out with chop-sticks from time to time, as one of the family requires food. Fish is also spitted before the fire on sticks, which are stuck in the ashes. All their food is either boiled in the pot or roasted on sticks in this manner.

## SAKÉ DRINKING.

From certain allusions in what are presumed to be native folk-lore stories, it would seem that the Ainos have long known how to make a kind of fermented drink from rice and millet. It is not unlikely that they were taught by the Japanese. I am not aware that they do at present make any such beverage, but they are inordinately fond of Japanese saké. They will do almost anything to get saké, and they drink it cold in great excess whenever they can obtain it.

The usual form of saké cups, which, as already stated, are among the treasures of the household, is represented in Fig. 77. The peculiar carved sticks are mustache-lifters. These are made by the Ainos, as the carving shows, but some of them are lacquered. The Ainos at Shari and also at Bekkai claim, as I understood the jargon, that their ancestors were acquainted with the use of lacquer and that they made the sticks. I am disposed to doubt these statements, but it is a question how they obtained the lacquered sticks. Some of these are certainly quite old, and they were highly valued by their possessors, who probably would not have parted with them but in consideration of a reward of saké in addition to the price demanded. When they were obtained, the carving was quite filled with dirt, but that did not interfere with their proper use by the people.

Saké is taken with much ceremony. One evening I visited the Ainos at Shari, a bottle of saké in my pocket and a paper lantern in my hand. I wandered along the shore in the darkness and slowly made my way to the Aino village. In spite of the howling and barking of many dogs, the people were taken by surprise. The men were sprawling about on the dirty board floor around the rectangular fireplace. When they recognized their uninvited and late visitor, they got up, spread a clean mat for me, and signified their welcome by stroking the beard. When I handed them the saké there was more beard stroking. Then they got some saké cups and a tray of mustache-sticks, finer than any I had seen, and began the ceremony of drinking. A saké cup with its stand, such as is represented in Fig. 77, is placed in front of the chief man, sitting on the floor before the fire, who places one of the sticks across the top, as shown in the same figure 77. Then, stroking the beard, he lifts the stand and cup with both hands, and bows the head, immediately replacing them. Saké is then poured in, and he begins to recite a long formula, which continues in a low voice during the succeeding operations. Taking the stick in the right hand, precisely as one would hold a spoon, the end is dipped into the saké and gracefully moved for-

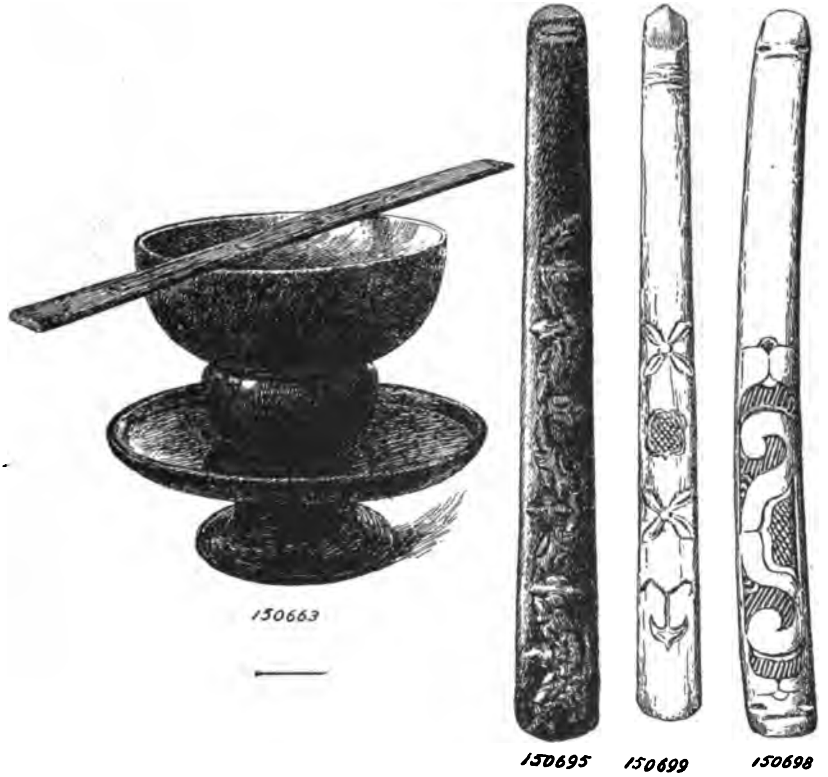


Fig. 77.

SAKÉ CUP AND STAND, AND MOUSTACHE STICKS.

ward, as though throwing some saké into the fire. Dipping the stick once more, a drop is thrown over the left shoulder. These operations are repeated two, three, or more times. The stick is then replaced on the cup, the whole is again raised, and finally the stick is used to lift the mustache while drinking.

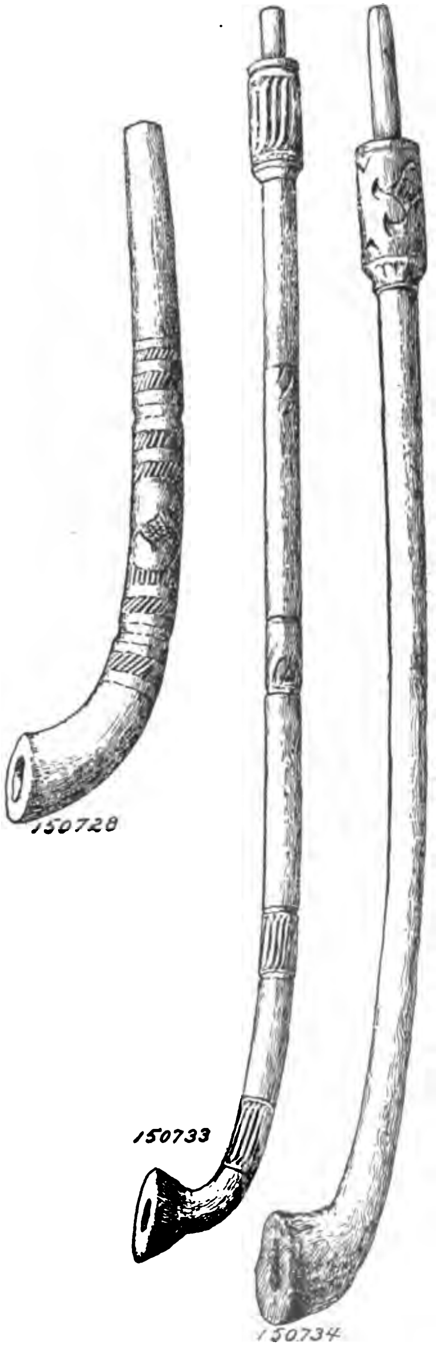


Fig. 78.
AINO TOBACCO PIPES.

No words can give a true impression of this ceremony. It must be seen in the surroundings of an Aino hut: the shiny, blackened rafters above; the begrimed, bearded faces and unkempt hair, lighted by the faint gleam of a burning wick in a plate of oil, and the fitful flame of a smoky wood fire.

At Piratori the ceremony was slightly different. I noticed that the famous old chief Benri, who by the way, it may be remarked, speaks of Miss Bird as the "woman to whom he told so many lies," took the largest share of the saké, for he not only had a large cup, but it was filled quite to the brim; while his son was served with a cup but partly filled. One of the men went to the east window and there performed his ceremony in silence, waving his stick three or four times to the east.

The women sat behind the men, and the latter, after having themselves drunk, passed the cup behind them to their wives, without turning. But the women do not get much, for the Ainos consider that saké was only made for the gods and men.

Mr. Batchelor tells us that in drinking saké "three drops must be given to the fire goddess, three thrown toward the east window, and three toward the northeast corner of the hut, where the Aino treasures are kept, and then three drops must be offered to any special god, for whose benefit the libations are offered, or to whom the Ainu are paying worship." I have not observed any such regularity in their proceedings. I should say they were as likely to offer two or four drops instead of three.

The saké drinking at the great Aino bear feast, as witnessed by Dr. Scheube, is described in the account of that festival.

### SMOKING APPARATUS.

The smoking apparatus consists of very simple wooden pipes, and tobacco boxes also of wood, attached with cord to long, carved sticks, which may be stuck in the girdle. Several pipes are shown in Fig. 78. The pipes may or may not have a short mouth-piece of bamboo.

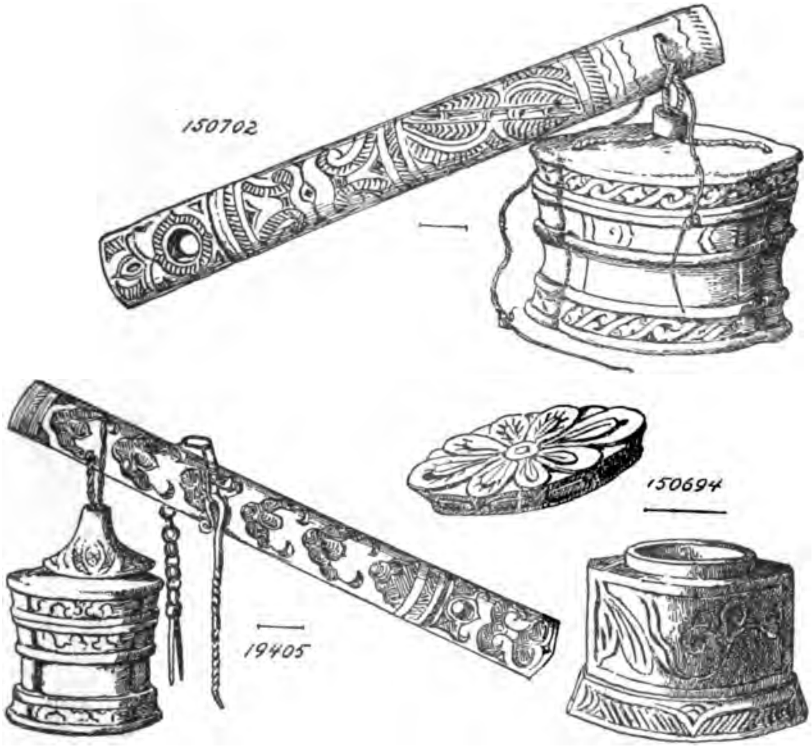


Fig. 79.

TOBACCO BOXES AND STICKS.

The tobacco boxes are usually oval in shape and often very well carved. In Fig. 79 three of these are well shown, attached to their sticks.

## MUSICAL INSTRUMENTS.

The Ainos are not a very musical people, and the only instrument that can positively be identified as their own is a kind of Jew's harp made of bamboo. Fig. 80 shows this instrument and how it is played. The one in the Museum collection measures 5¾ inches in length.

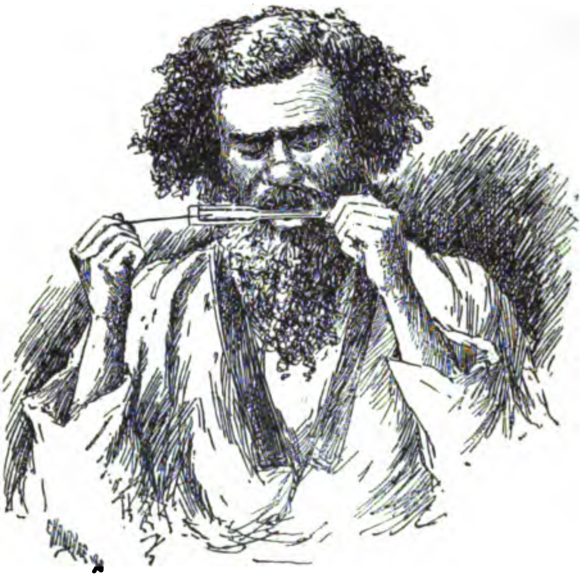


Fig. 80.
A MOKURI PLAYER.

There is a kind of five-stringed guitar, which I have only seen figured in books. At the Sapporo Museum there is a three-stringed instrument, but of quite a different shape. The former, known as the *tonkari*, has been described by Dixon in the "Chrysanthemum Magazine," of 1882, where there is an excellent illustration; but since that publication is not now accessible, Fig. 81 is copied from a Japanese *makimono* belonging to Dr. G. Brown Goode. Mr. Blackiston, in speaking of this instrument, says it was mentioned by a Japanese traveler in Yezo long before the Ainos from Saghalin took up their abode in Yezo, from which he infers that it was not introduced from Saghalin. It is not common, and in the course of my travels I was unable to discover a single one, although the instrument was known to the Ainos in different sections of the country.

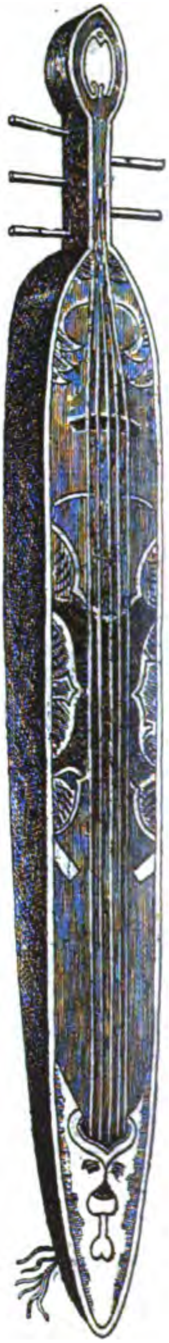


Fig. 81.
TONKARI.

## WEAVING.

As already stated, the Ainos use the bark of the *Ulmus montana*, which they call *ohiyo*, sometimes also the bark of *U. campestris*, for the manufacture of cloth. The fiber is not disintegrated, as for spinning, but the bark is softened by soaking in water and working, when it is easily separated into thin, wide ribbons, and these are readily split into long, slender threads. These threads are tied together end to end, without twisting, and wound into balls. Such threads are used for both warp and woof.

The loom is simple, but well made. Fig. 82 represents an Aino woman engaged in making the *ohiyo* cloth. The weaver sits on the floor, passing the rope at the lower end around the body, and stretches the warp by leaning back against it. As the cloth is woven, it is rolled on the stick in the well-known manner.

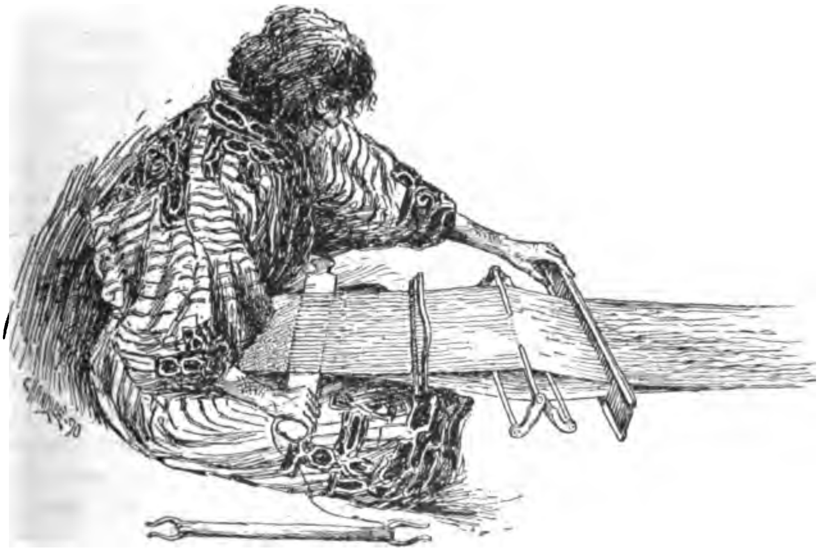


Fig. 82.
Aino Woman Weaving.

Mats are woven in the same manner as in Japan. Plate CIV represents an Aino woman making a mat. The long binding-threads are weighted with stones at the end and thrown over the beam, alternately backward and forward, twisting the threads each time. Such mats, varying greatly in size, are in universal use among the Ainos. They are made of the rush known by the Japanese as *suge*, *Scirpus maritimus*. They are usually woven with brown and black squares, arranged in peculiar but regular patterns. The colored parts are made with dyed bark, probably because the rush does not take color well. The bark of *Shina-no-ki* (*Tilia cordata*) is usually employed for the colored portions, but I have also specimens of the *ohiyo* bark from Abashiri, which have been colored black and brown for the same purpose. The brown color is produced by soaking the bark in water along with the bark of *Æsculus turbinata.* The black color is similarly produced from the bark of the *han-no-ki*, (*Alnus Maritima.*) The *suge* is also used for making small bags. Similar bags are sometimes made of straw.

The bark of the Linden (*Tilia cordata*) is much used for twine, and a strong braided cord is made of this fiber. The Aino fish-nets are made of the same material.

### CARRYING BURDENS.

The usual mode of carrying burdens is by means of a band of woven or braided *ohiyo*, *Ulmus Montana* bark, passing over the forehead and tied behind the load on the back, as represented in Plate CV. These bands, called *tara* or *packai-tara*, are used also for carrying babes on the back. Sometimes a straight stick, about 15 inches in length, is tied so as to hang horizontally in the proper position to support the burden, as shown by one of the bands in the collection. The Aino women make great use of these *tara.* They will carry very heavy loads with them, and it is customary for them to bring large tubs of water to their homes precisely as the man represented in Plate CV is carrying an empty tub.

### MODE OF GREETING.

The Aino ceremony of greeting is simple and pleasing. The two hands are placed together with palms upward and outward. They are then gracefully raised to the chin and moved downward, stroking the long beard. They may not indeed touch the beard, but the movement is the same. It may be shortened to a mere flourish of the hands, just as a bow may be made formal or short.

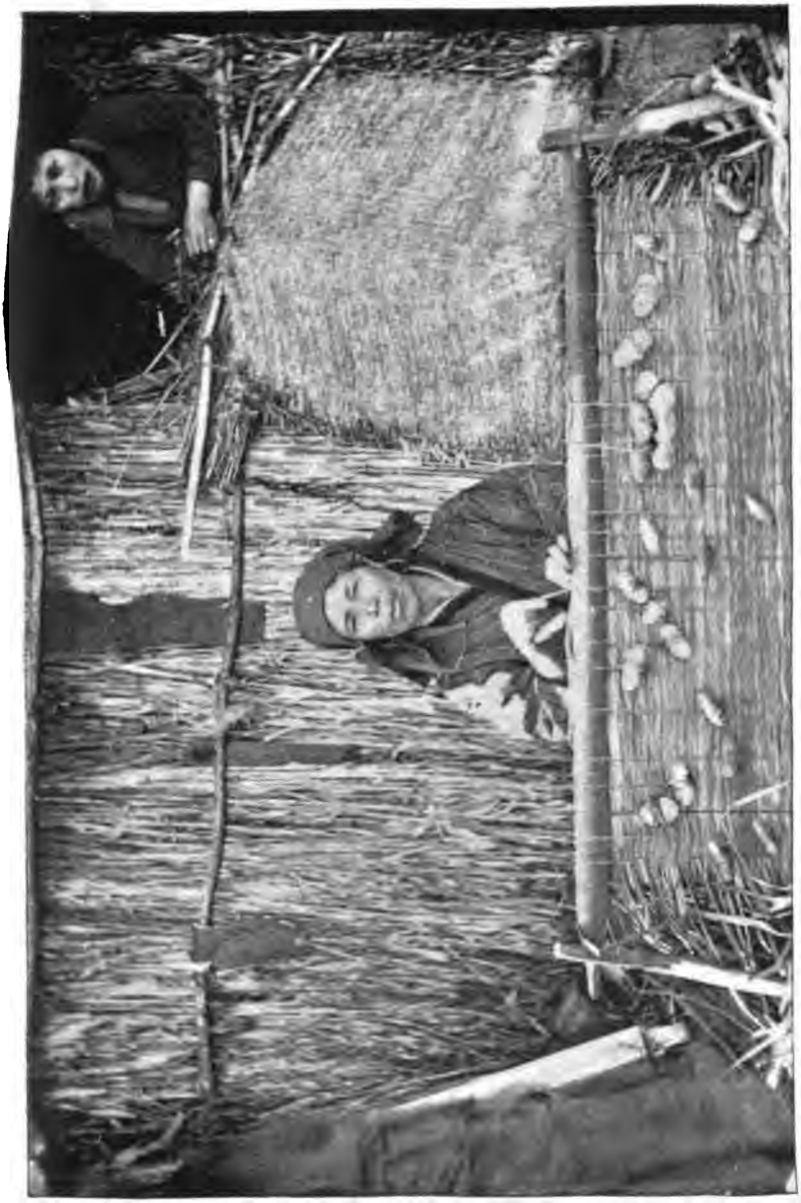
It is now quite customary for the Ainos to bow in greeting. Sometimes they squat on the floor, and then bend over until their foreheads nearly touch it. This custom is undoubtedly borrowed from the Japanese, and is not at all pleasing, as their original form of greeting certainly is. A good description of the usual form of greeting is thus given by Mr. Blackiston:

> My Aino was a stranger to these people, so on meeting, before exchanging a word, he went through a ceremonious form of salutation individually with each of the principal men. This they performed by going down on their knees, holding out the hands with the palms together, rubbed them backward and forward twice, the saluted party following the motions of the saluting one, then raised both hands to a level with the chin, palms uppermost, lowered them, raised them again, stroking the beard, lowered them and performed the last operation over again, which completed the ceremony.

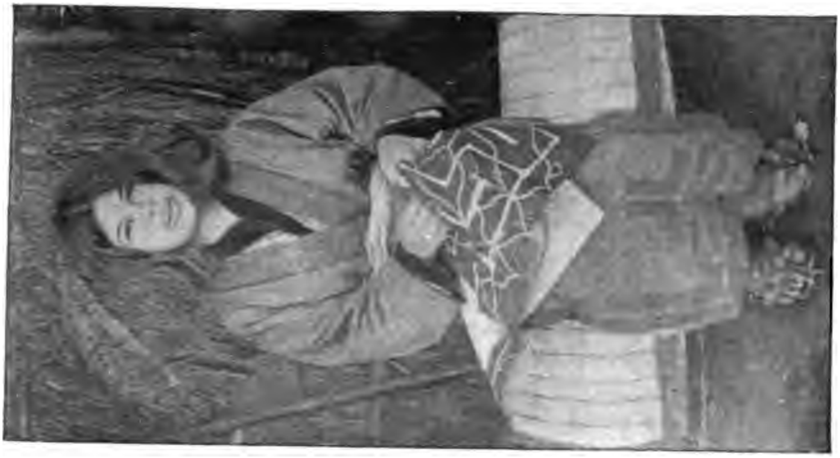
Mr. Greey thus describes the Aino greeting represented in Plate CVI, taken from the original Japanese drawing:

> The three chiefs placed their left hands over their right and began to rub them. This they continued to do for over five minutes, during which time they looked very

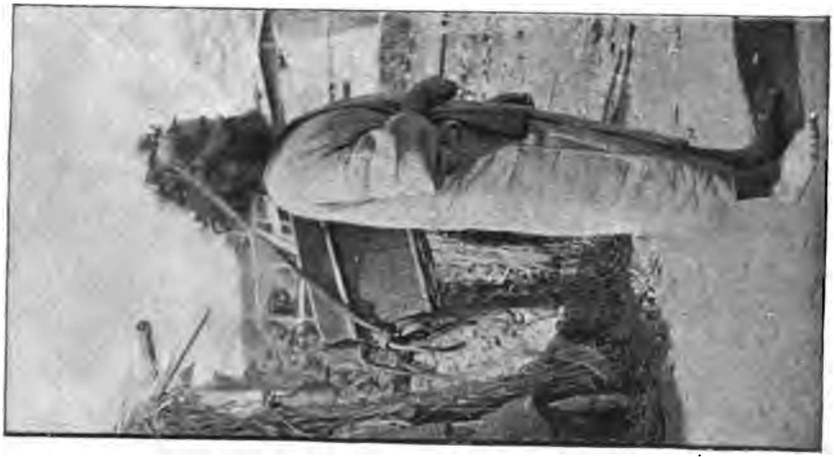
PLATE CIV.



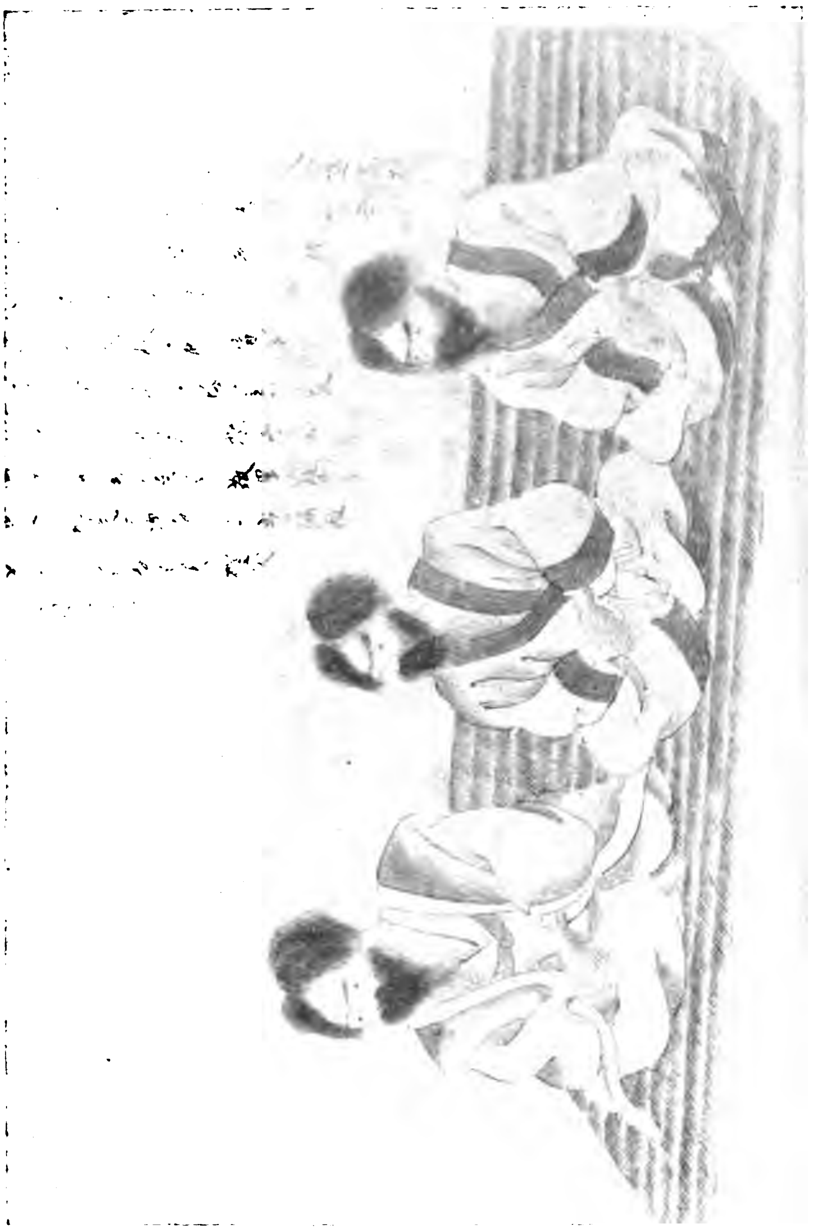
AINO WOMAN MAKING A MAT.



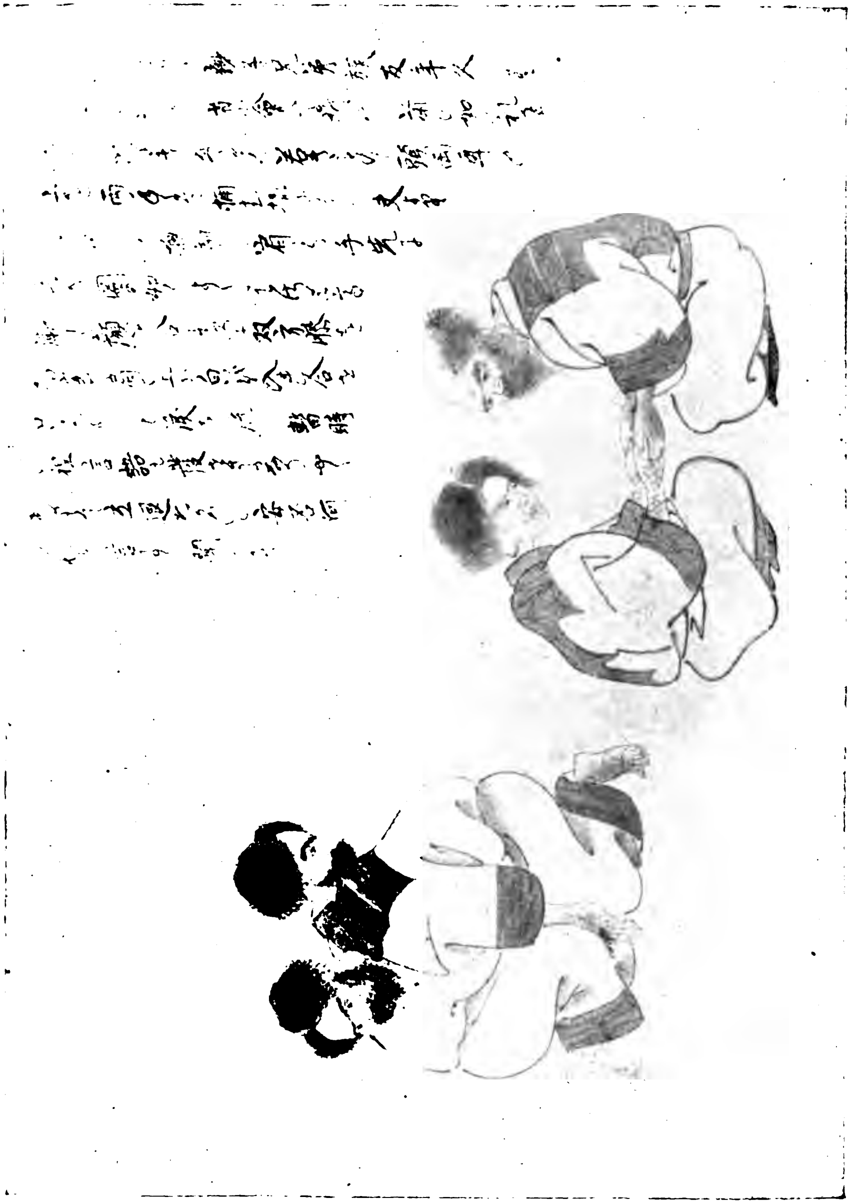
GIRL EMBROIDERING.



MAN CARRYING A TUB.



AINO CHIEFS SALUTING.



AINOS GREETING.

grave and regarded the foreigners with great reverence. They then raised their hands and placed them on top of their heads and brought their hands down over their faces and beards and uttered a whining noise, ending with a sharp cry like the bark of a dog.

I have never seen this ceremony carried out in full, as described, but I doubt not the description is correct, for I have observed both the holding of the hands together and the stroking of the beard. Another form of the ceremony (Pl. CVII) represents the meeting of brother and sister, also from Mr. Greey.

The man held the woman's hand for a few seconds, then suddenly releasing his hold, grasped her by both ears and uttered the Aino cry. Then they stroked one another down the face and shoulders.

This form did not come under my observation, nor did I witness any such performances as the same author describes in the meeting of father and son.

### MARRIAGE CUSTOMS.

The best account of the marriage customs is that given by Dr. Scheube, from which the following particulars are abstracted: the Ainos marry early, the men at about the age of 18, the women at 16; polygamy is permitted, but not much practiced; morality between the unmarried is not very strictly enforced, but children born through such relations are no bar to future marriage.

The marriage customs resemble those of the Japanese. The parents usually select wives or husbands for their children. A young man rarely courts his wife directly, but through a go-between. As soon as the matter is satisfactorily arranged by the latter, the young man sends a portion of saké to the parents of his intended bride. After some time the latter sends a gift of saké and an *inao*, or God-stick, to the bridegroom. This is a sign that the marriage is to take place on the next day. In the evening of that day the neighbors assemble at the house of the bridegroom's parents. The bride comes in company with her parents and the intermediary. They depart about midnight to re-assemble the next morning, and the feasting goes on for 2 or 3 days, according to the circumstances of the young couple, who from henceforth live in the house of the man's parents.

Not many children are born; usually 3 or 4, and more boys than girls. The children are suckled until 4 or 5 years of age.

Divorces are not common. A man can only send his wife back to her parents by obtaining their consent.

### BURIAL CUSTOMS.

Burial usually takes place on the day of death or on the following day. The friends and relatives assemble, bringing with them food and saké, which are placed before the body and, after the burial, shared by all in common. The corpse is clothed and placed in a wooden coffin, lying at full length, with household implements and weapons; but no food or drink is offered, nor is either placed on the grave. The coffin is placed in the ground, with the head to the east. Each mourner throws earth upon it and a rude monument is erected.

It is difficult to find the burial places, which are in desolate, unfrequented spots, seldom visited by the people. Dr. Scheube remarks that the Ainos give no thought to the departed and seem to have a dread of visiting their graves. Several forms of monuments are represented in Fig. 83, standing at the head of graves, which, however, were not grouped together in the manner shown in the picture. Each grave is marked by an upright post and a recumbent log. The one on the left is from Urap, not far from Hokadate. The drawing was copied from a photograph. The two in the middle are from Dr. Scheube's plate.

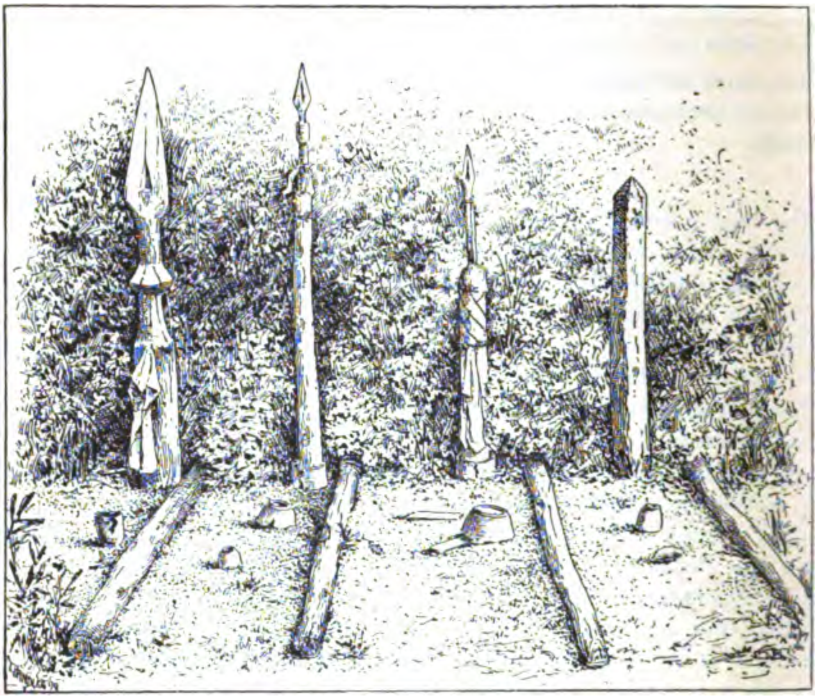


Fig. 83.
AINO GRAVES.

The straight post with a rude X and pyramidial apex represents the form of several monuments, which I found under the guidance of a Japanese near Tokoro. A long tramp through tangled underbrush, soaked by the recent rain, brought us to a lonely spot behind the village. The posts were at the west end of the graves, and the X mark faced the west. It was not on the side overlooking the grave, as it is shown to be in the drawing.

The height of the monuments varies from 3 to 6 feet, and depends upon the age and position of deceased. Monuments for women are plain posts, not so high as those accorded to men.

Mourning customs vary greatly in different parts of the island. The period of mourning may last three days, or as many years. This is a subject concerning which little seems to be known. Formerly it was the custom to burn the houses of the dead, but this is no longer done in Yezo.

## PUNISHMENTS.

In the museum at Sapporo there is a collection of clubs, carved in rough relief, which the Ainos use in punishing wrong-doers. Their punishments are severe, but they do not take life, even for the crime of murder. The murderer is bound to a cross for a week, and, after his release, receives some good advice from the judge, when he again takes his place as an honorable citizen.

The clubs are used for punishing thefts and other crimes. The prisoner is stripped to the waist, and heavy blows are delivered upon the bare back. The Ainos also have certain trials to prove the innocence or guilt of the accused person, such as the trial by hot water, in which a stone must be picked from the bottom of a kettle of boiling water, and the trial by a heated iron, which is supposed not to burn the flesh of one wrongly accused. Mr. Batchelor states that a murderer has his nose and ears cut off, or the tendons of the feet severed. These cruel punishments are undoubtedly old practices no longer in vogue, although one can not speak very confidently as to the cause of their discontinuance, unless it be due to Japanese control. H. von Siebold has supposed, from these old customs that the Ainos were once a savage and warlike people. They may have been so, as one might infer from Japanese tradition, but it seems to me unsafe to make the assumption on the grounds suggested by Von Siebold. Their present character does not sustain it in any way. Sympathy, regard for physical suffering of others, are not early developments in human character. Lingering traces of savage heartlessness and cruelty are still recognized in the practices of our own children.

## HUNTING AND FISHING.

Wild animals, as bears, deer, foxes, and many others, abound in the Yezo forests, while the sea yields an abundance of fish of an excellent quality. The Ainos are brave hunters, and they are largely dependent on the chase for their animal food and winter clothing. Their hunting implements, however, are of the rudest description. The bears of Yezo, which are the same as the brown or grizzly bear of North America, are large and dangerous. At certain seasons they do not hesitate to attack man, even entering the dwellings in search of food. These ferocious brutes are fearlessly attacked with such inferior weapons as the bows and arrows represented in Fig. 84. One bow in this figure was obtained from an old man at Shari, who, in a most dramatic manner, illustrated the manner of shooting bears. The bow is strung by taking the free end of the string between the teeth and drawing up the slack while the hands are employed in bending the wood. The best bows are made of the wood of *Taxus cuspidata.*

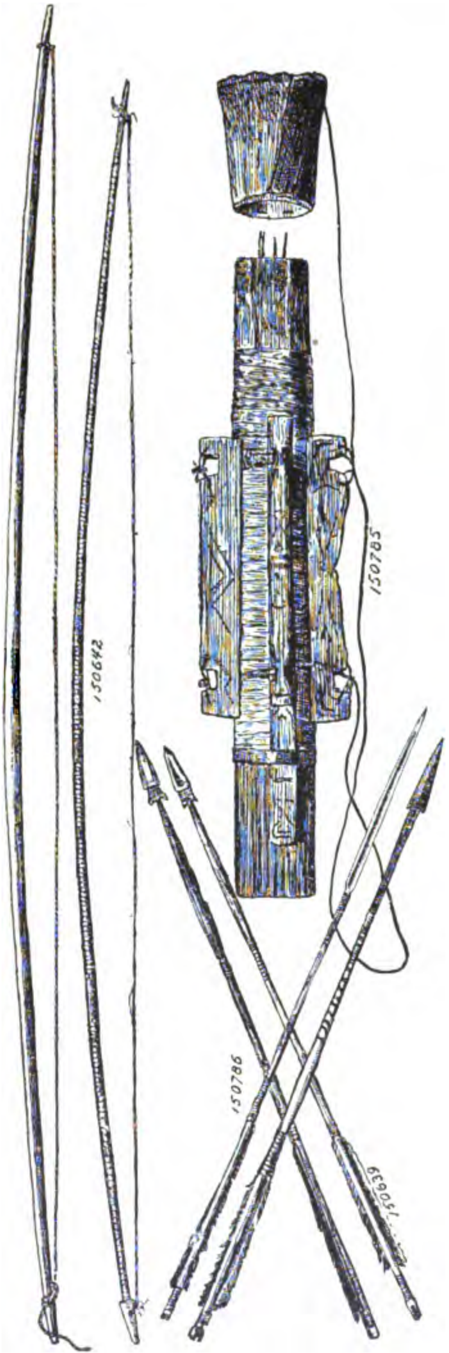


Fig. 84.
Bows, Arrows, and Quiver.

The arrows are made in different ways. Some of them are plain, straight shafts, with iron heads and feathered ends. Not long since, stone heads were in use, but now Japanese iron is hammered into heavy barbed points. Since the introduction of knives, bamboo heads have been adopted. By so cutting the bamboo that the hard cortex of the stem forms the point and edge, very excellent arrow-heads are made. I have seen an arrow-head of this kind driven from a bow into a board with great force without noticeable injury to the point. The shaft is usually made in two sections. The notched end is usually a length of reed (*Phragmites*) or of scrub bamboo, at the lower end of which the feathers are tied with fine bark fiber. This is joined to a somewhat shorter length of wood, the upper part of which tapers, and is inserted into the base of the bamboo or bone head. Such jointed arrows are shown in Fig. 84. The heads are secured with resin and bindings of bark, but they are easily detached.

The arrows are carried in quivers, one of which is shown in the figure. The quiver is slung under the left arm by means of a cord passed over the shoulders on the same side.

The arrow release is of the simplest kind, the arrow being held between the thumb and forefinger.

Large animals, like the bear, are always hunted with poisoned arrows; hence it is not necessary that the bows should be very powerful. If the arrow only penetrates the skin it is sufficient to kill the animal. Wherever bears abound, the woods are made dangerous to travelers by the number of set-bows with poisoned arrows, so arranged that when a bear or other animal treads upon a cord, the arrow is released and the deadly shaft enters its body. A Japanese artist has represented such a device in Plate CVIII.

The preparation of arrow poisons is generally held by savage people as a secret art, which they do not readily reveal. The method of preparing the arrow poisons of the Ainos has only been made known to a single traveler, Dr. B. Scheube, who believes that his information is correct, because the accounts obtained in different localities entirely agree. Dr. Scheube's account is, in brief, as follows:

The young side roots of *Aconitum Japonicum* are usually gathered in summer and dried in the shade until fall. The roots which contain active poison become softer, while the others grow harder; apparently a process of fermentation takes place. The former, after removal of the skin, are rubbed between two stones to a pasty mass. There is no further preparation. This material is either spread directly upon the arrowheads or preserved. The poison preserves its activity for five months. Dr. Scheube adds that in every village the poison is prepared only by a few old men, not because the process of preparation is unknown to the others, but because these men have had experience in its production. Prayers, magic formulas, and the like are not recited during the preparation.

The activity of the poison is tested by placing a portion on the tongue. To insure its action, each arrow receives portions from three different preparations. According to the Ainos, a wounded bear runs at the farthest not more than 200 metres before falling dead.

Dr. Stuart Eldridge* has made some chemical and physiological investigations of this poison, which confirm the supposition that aconite is the active ingredient thereof. But this writer declares that the pulp prepared as described "is mixed with other ingredients, which I have been unable to identify, but which are probably inert, and the resulting mass is buried for a time in the earth. On removal from the earth, the poison appears as a stiff, dark, reddish-brown paste, through which fragments of woody fiber are distributed. The poison, when applied to the arrow, is mixed with a certain proportion of animal fat."

I was able to obtain two specimens of the poison, which are in the form of hard lumps. Specimens of the plant from which the poison is obtained were also collected and determined by Mr. Theo. Holm as *Aconitum Japonicum.* In some parts of the country it grows in great abundance, and the fine purple flowers are very pleasing to the eye.

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* Trans. Asiatic Soc. Japan, IV, 1875–'76, 78

Small animals are caught in rude, but rather ingenious bow traps. The bow is set in a frame, as in a crossbow. The heavy arrow-shaft is notched on the side to receive the bowstring and carries a T-head. When the trap is set, the bait is placed between the T-head and the end of the frame, in such a manner that any attempt to remove it releases the string, and the T-head comes down and securely holds the animal.

In deer-shooting they have a peculiar instrument made of bone and bamboo with teeth like a comb, with which they can imitate the cry of a deer. Concealed in ambush, the hunter thus calls the animal within range of his bow.

Fishing, as at present conducted, is mostly in the hands of the Japanese. This is particularly true of the coast fisheries. Aino settlements are occasionally to be found along the banks of the larger rivers and their important tributaries, where the most primitive devices are still in use. Perhaps the most curious of their devices is a kind of spear, which is shown in Fig. 85. This is lashed to a long shaft, and is used for spearing salmon from canoes or on the river bank. The curved gaff is made of iron. It is secured to a line passing through the spear end, and the shank rests in a groove in one side, as shown. When the fish is struck, the gaff turns over, as represented by the dotted line, and hooks into the flesh, held only by the line or strip of hide, by which the fish is pulled in. Mr. Blackiston has described the use of this spear in the following words:

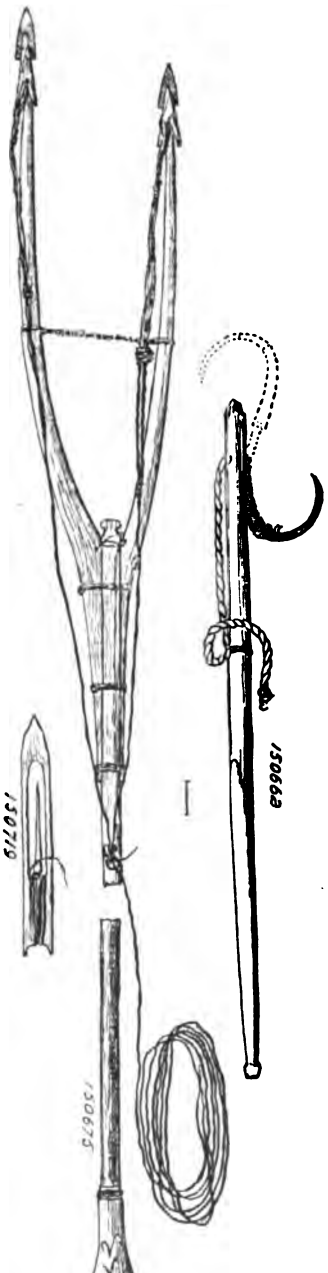
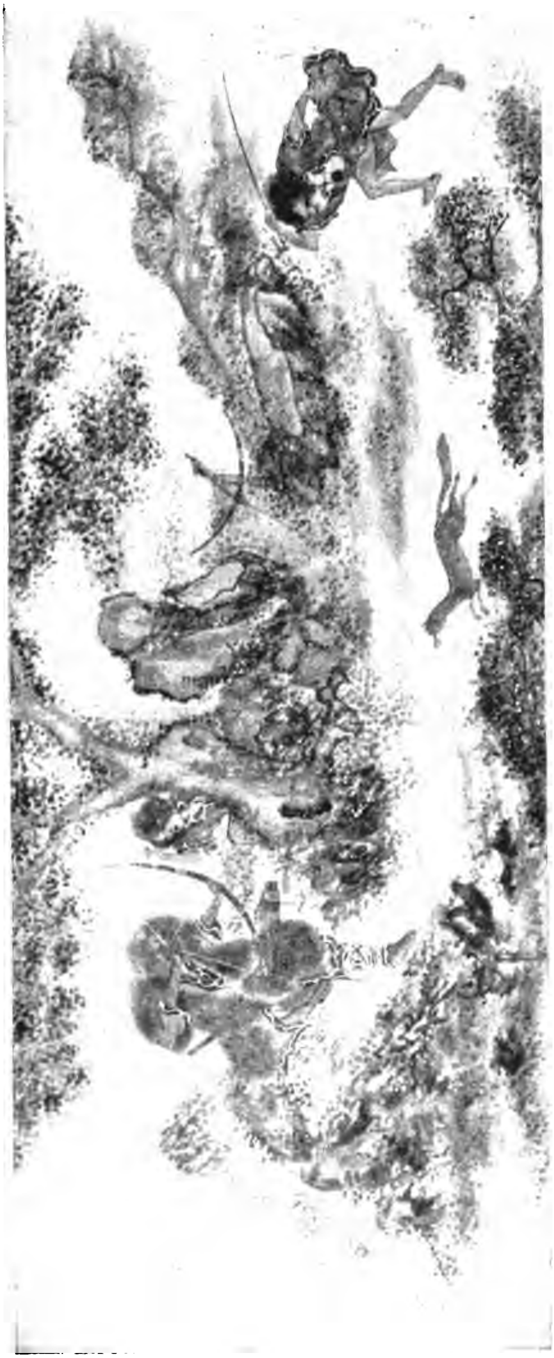


Fig. 85.
SPEARS. NEEDLE FOR MAKING FISH-NETS.

> They [the Ainos] are expert in the use of the spear, often striking a fish in motion as much as 3 feet under water at some yards' distance, but generally the fish is "jabbed" with-

PLATE CVIII.



HUNTING SCENE, SET-BOW.

out the pole leaving the hand. They have wonderful sight for fish under water. Their dexterity is induced by their using the spear almost from infancy. You can not go on the river any day during the salmon-trout season, provided the water is clear enough, without meeting brown urchins of all sizes prowling along under the steep banks in small canoes, or crouching on fallen tree-trunks, peering down through the interstices of masses of driftwood, with their spears ready for a dart at the fish. It is very pretty to see the men chasing the fish in their canoes, in which they stand upright and guide back and forth by using the blind end of their spear pole, at times making sudden rushes with cries of excitement to head off a fish; at others allowing the canoe to float down with the current, while they scan every inch of the water to detect a passing or stationary fish, with their spears poised at arm's length above the head ready for a strike, standing often on the gunwale of the canoe in order to get a downward view into the water. Their positions often in such cases are grand, while their features, worked up to the highest expression of expectancy, make a most animated picture of savage life. The Aino seems then really in his element, even more so than when, mounted bareback on a horse with only a rope halter, he is seen flying over plain, swinging a lasso around his head, driving a herd of half wild ponies toward a corral.

Mr. Blackiston describes a peculiar method of catching salmon, as follows:

> On the Kaminokuni River I found the people preparing salmon weirs, which they build of stakes, brush, and mats, funnel-shaped, near the bank in such a way that most of the fish must pass through them. At night they squat alongside, having a gaff fitted to a pole, limber at its end. This they keep on the bottom or allow to drift along the bottom inside the weir, and when they feel a fish jumping over the stick, suddenly jerk it toward them and so gaff the salmon.

Another form of spear, double-headed, is also shown in Fig. 85. This two-headed spear is used for spearing seals, whales, turtles, and large fish. The two bone or iron barbs are merely pressed on the tips of the shaft, so as to be readily disconnected and left in the body of the animal. They are screwed to the ends of a tough strip of hide, to the middle of which is attached the long braided rope. The shaft is 11 feet in length and has a crotch at the end over which the line passes.

It is customary to poison the heads for seal fishing. The manner of using this spear is shown in Plate CIX, taken from a Japanese drawing. Here and there along rapid streams the Ainos build dams of stone and brush wood, which cause the water to flow through narrow apertures with unusual force. Just below these openings large flat platforms of boards are placed. The fish, swimming up the current, reach these dams, and in attempting to pass the obstructions some of them fail, and the force of the water throws them upon the platforms, where the fisherman easily secures them. The native fish-nets are made of the strong twisted linden bark. The fisheries of the coast are very important, but as conducted now they can scarcely be regarded as an Aino industry, since they are controlled by the Japanese who engage the Ainos in the work. Immense numbers of herring are converted into an excellent fertilizer, which is shipped to enrich the soil of the main island, and even tons of the beautiful and valuable salmon-trout, or spring-salmon, as it is called on the west coast of the United States, are each year utilized for the same purpose. The true salmon is also abundant on the coast. The fisheries of Yezo are too valuable to be conducted in the present careless and wasteful manner, and by proper government control might readily become a great source of wealth to Japan.

## BOATS.

The ordinary river boats or canoes are dugouts. A common form is shown in Plate CX, from Tokoro on the north. A different form from Urap is represented in Plate CXI. The dimensions of a dugout at Tesikaga, a small village far up the Kusuri River, were as follows:

| | | |
|---|---|---|
| Width of ends | inches.. | 11 |
| Width of middle | do.... | 28 |
| Length, about | feet... | 26 |

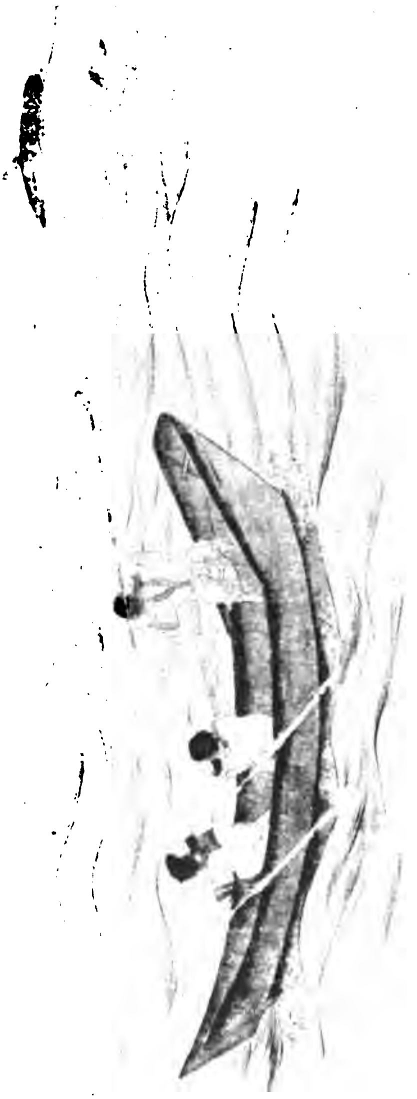
This boat was made of a single log, with considerable sheer at the ends.

Boats intended for rough water are often built with dugout logs for the bottom, and a free-board of considerable height made of planks bound on with bark lashings. Many of the large fishing boats are made in this manner and they are exceedingly strong. They measure perhaps 50 feet in length and 10 feet beam, with a great sheer, especially in front.

## RELIGION.

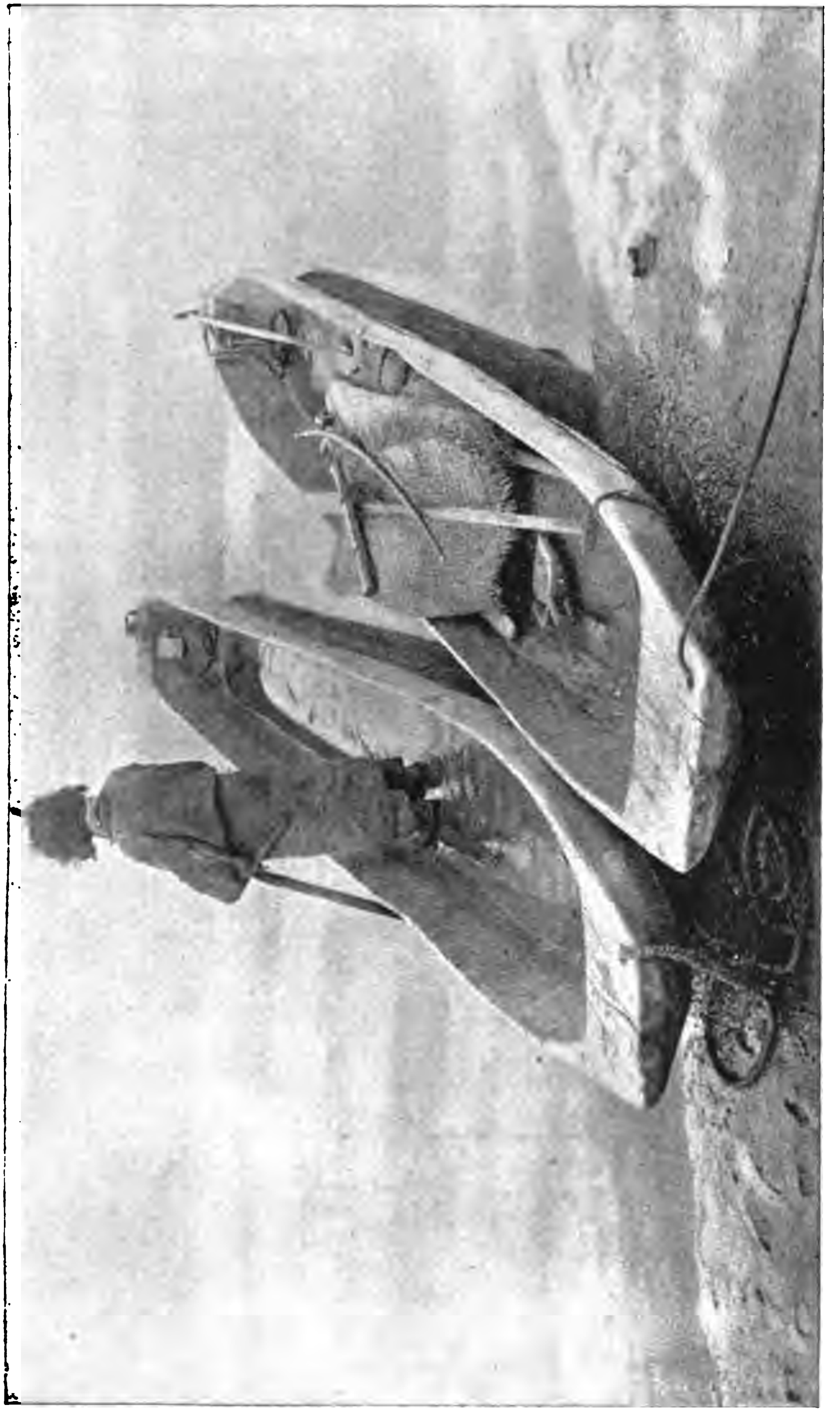
The Aino religion is a very primitive nature-worship. The gods are invisible, formless conceptions, known as *kamui*, such as the house god, the god of fire, and the deities of mountain, forest, sea, and river. The sun and moon occupy a subordinate position among them. There are no priests nor temples, but within every house there is one corner sacred to the house-god. The god of fire, who is esteemed highest of all, is worshiped at the fire-place in the middle of the room. The others receive their due at the *nusha kamui*, or sacred hedge (Pl. CXII), which will be described in the account of the bear feast further on. It might naturally be supposed that this rude structure of branches and poles represents what was originally a hedge or fence built around the house for protection against the inroads of wild beasts, or possibly against enemies. The skulls of bears and foxes may have originally been placed upon the hedge as charms against evil. All this, however, is purely speculative; but there is a picture in Mr. Greey's book, "The Bear Worshipers of Yezo" (p. 105), representing a house of rather unusual form, which is shown to be protected on at least three sides by a rude sort of fence, such as may well be regarded as an early counterpart of the *nusha kamui*.

In addition to the sacred hedge, upon which the bear and fox skulls are displayed, there is a smaller hedge, before which the hulls of food-

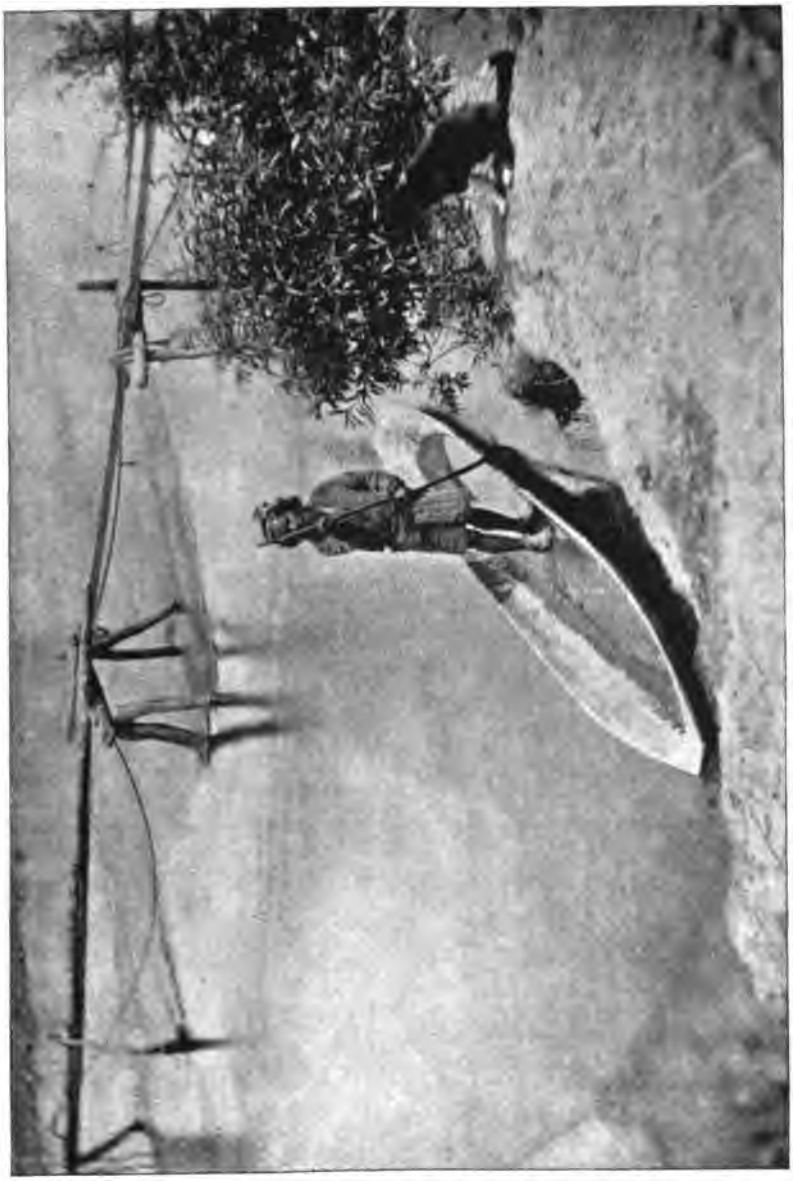


SPEARING SEAL.

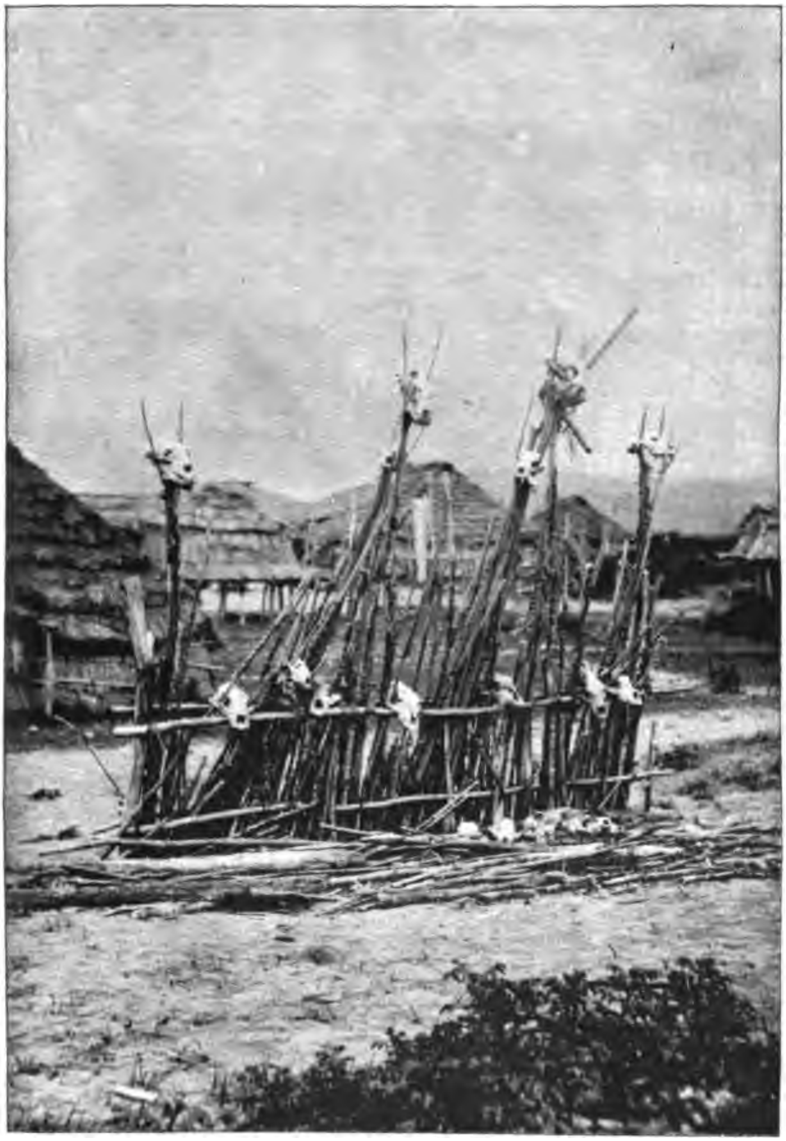
PLATE CX.



AINO RIVER BOATS, TOKORO.



AINO RIVER BOAT, URAP.



SACRED HEDGE, NUSHA KAMUI.

grains are thrown in heaps. This is known as the *murukuta-nusha* (*muru* hulls, *kuta* to throw), and it is under the special protection of a female deity, who would be offended if the hulls were thrown broadcast over the ground.

Storms are caused by the strife of the thunder-gods who dwell in the clouds. These gods are associated with the lion, for it is related that the people once caught a lion, which escaped on a black cloud. The thunder is the noise of battling hosts, and the glancing, swords the lightning. At least so says Dr. Scheube, but the idea is almost too poetical for the Ainos.

Some of the Japanese deities have found a place among the native gods, but these are foreign to the spirit of the Aino religion and can scarcely receive great reverence. In one house I saw three shrines, evidently representing the Japanese *kami dana*. Before one of them were some faded artificial flowers standing in bottles clearly labeled "Lemon Drops, J. T. Morton."

The Japanese hero Yoshitsune is supposed to have fled to Yezo, and is generally regarded as the famous personage known to the Ainos as Okikurumi. It is said that the Ainos have only a single divinity of human origin, the ancestor of the race, Aioina. Nevertheless, there has long been a simple shrine to Yoshitsune on the summit of a hill near Piratori, which Miss Bird has described. But this author* refers to Yoshitsune as "the great god of the mountain Ainos." It is even doubtful whether the Ainos did in fact worship Yoshitsune as a god; certainly it is incredible that he should be elevated to the high place assigned to him by Miss Bird. I was myself on the spot, with the famous chief Benri as my guide, but a recent storm, which had delayed me by making the rivers impassable, had also blown the shrine away, and its fragments were lying scattered down the steep hill-side.

The Ainos have but few religious symbols. The most important of these are the *inao*, frequently called god-sticks, three forms of which are represented in Fig. 86. In some way, not very clearly understood, these represent the gods. One or more will always be found stuck in the ashes of the fireplace, and others here and there at convenient places on the wall of the house. They are simply ingeniously whittled sticks, usually of willow, with the long curled shavings pendant. Some have short spirals directed upward and are covered with bark at the lower end. Further notes upon their variety and use will be found in the course of the description of the bear feast.

The sacred quiver is made of carved wood with various metallic trimmings representing the sun and moon. It is associated with the house god, but during the great bear feast it is hung on the sacred hedge. The skulls of bears and foxes are placed on the sacred hedge. The former are by far the more common, but every house is said to contain at least one fox skull, which may be a treasure handed down through several generations. The skull of a fox is supposed to ward off evil from the house. It is sometimes carried to the hunt and to sea as a protection against evil spirits. It is also consulted as an oracle, and questioned concerning articles lost or stolen, or when fishermen lose their way at sea, in order to learn the direction home.

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* Bird, Isabella L. Unbeaten Tracks in Japan, II, 72.

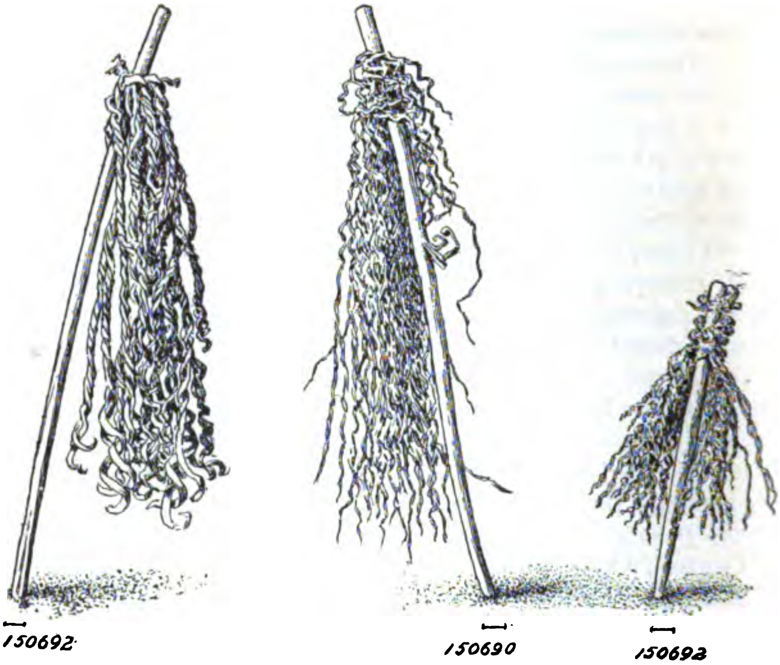


Fig. 86.

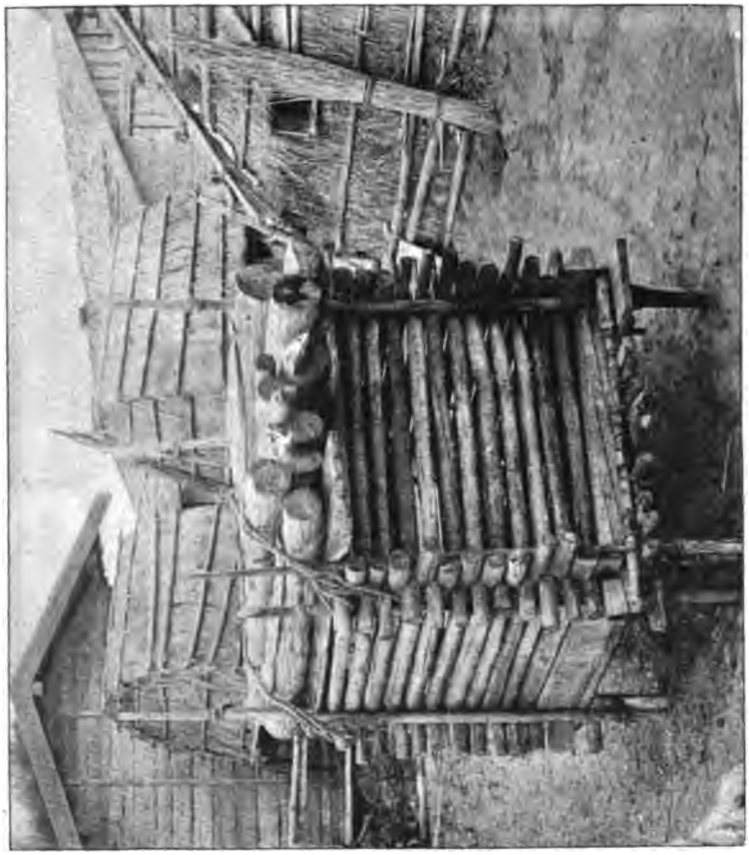
INAO — WILLOW STICKS WITH SHAVINGS ATTACHED.

## FORTUNE-TELLING.

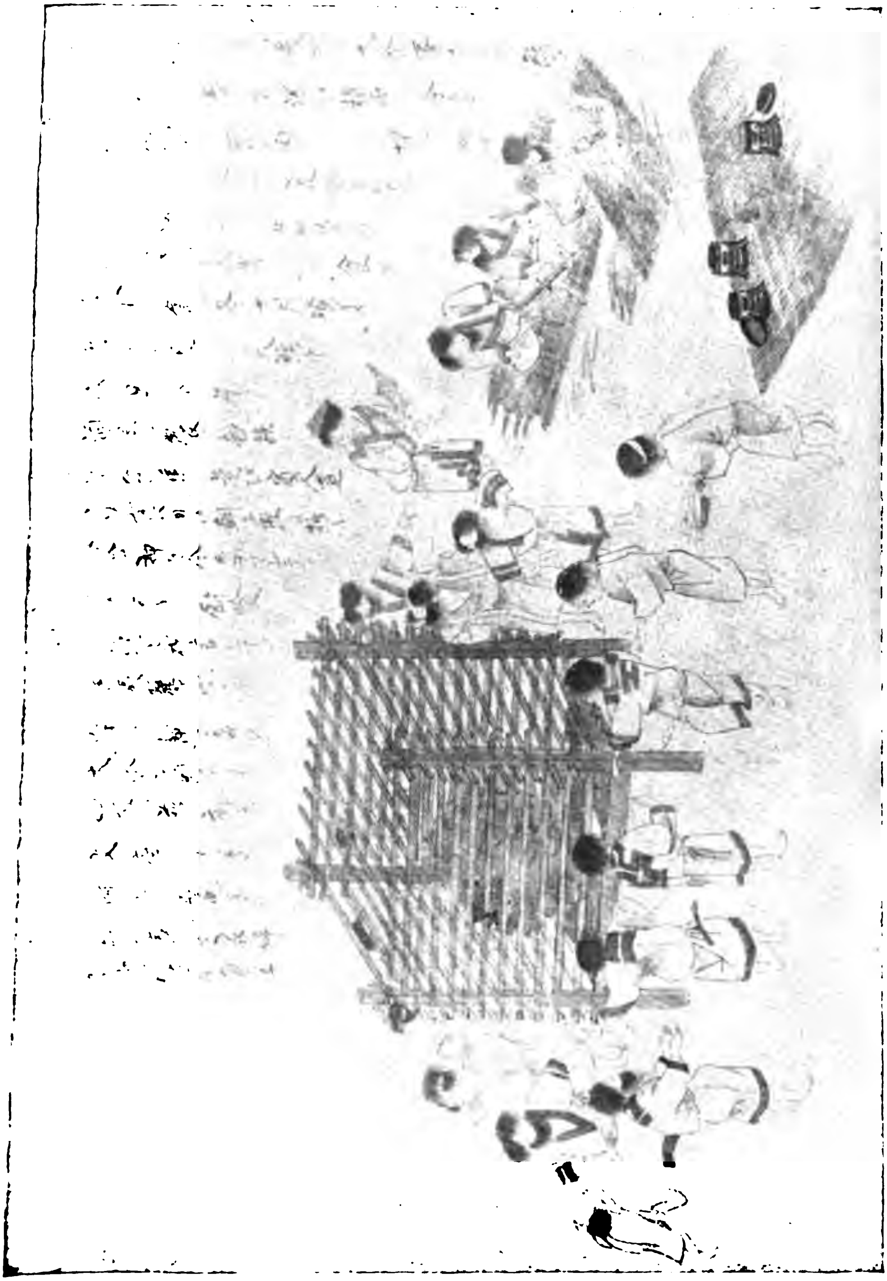
The manner of consulting the fox-skull oracle has been described by Dr. Scheube. After presenting a drink-offering, the skull is taken in the two hands while a prayer is spoken. Then, placing the underjaw on his head, the person bows forward until it falls, and the direction towards which it points, indicates the place where the lost or stolen article is to be found. If the jawbone falls on its side, or so that the teeth are down, the answer is not decisive and the question must be repeated. A thief discovered in this manner is not brought to trial, but the owner of the property waits patiently until the offender brings back the stolen goods and seeks forgiveness. The Ainos also read the lines of the palm of the hand.

## THE BEAR FEAST.

The great Aino festival is the so-called bear feast, which is celebrated in September or October. This festival is of such an important charac-



AINO BEAR CAGE, SHARI.



DANCE AROUND THE BEAR CAGE.

ter as to be worthy of a full description; but, since I was unable to be present at a celebration myself, I can do no better than to give a rather full account of the ceremonies as witnessed by Dr. Scheube,[*] who has published the only complete description yet given by an eye witness. The original article is rather long, but in somewhat condensing the description it is believed that no detail of importance or significance has been omitted.

Before entering upon a description of the festival the bear-cage and *nusha kamui* should be noticed. The bear-cage is represented in Plate CXIII. The cages are all of this general form, built of logs notched at the ends so as to hold securely together. The bear sometimes makes most strenuous efforts to free himself by scratching and gnawing with his teeth through the tough, heavy rails, so that it becomes necessary to take out the old ones and replace them with others. This is easily done, for, owing to the manner of putting the cage together, any rail can be replaced by prying up those above it.

I saw many such bear-cages in the course of my travels in Yezo, but it is said that they are less numerous now than they formerly were. The *nusha kamui*, or sacred hedge, already referred to, is represented in Plate CXII, from a photograph taken at Urap. It is also shown in some of the succeeding plates. This rude hedge of rough poles is an important structure in connection with the ceremony about to be described, as well as in other religious observances. The significance of the name is not exactly "temple," but it is the nearest approach to "temple" in the Aino language. Before it prayers are recited to most of the gods, although not to all, as we shall see. It is here designated "sacred hedge" for convenience.

Dr. Scheube witnessed the bear feast in 1880, and his account reads substantially as given below. Plates CXIV to CXVII, illustrating the ceremonies at the bear feast, are reproductions of Japanese drawings, from a makimono formerly belonging to Mr. Edward Greey, now in possession of the Assistant Secretary of the Smithsonian Institution, Dr. G. Brown Goode. Dr. Scheube has given two illustrations of the ceremony, which are substantially the same, although in one picture the crushed bear has his head directed toward the sacred hedge, while the men sit with their backs against the hedge. Perhaps there is no established custom in the matter, and such incidental changes are of no significance.

## THE BEAR-CULTUS OF THE AINOS.

[Condensed from Dr. B. Scheube.]

According to the accounts of travelers concerning the Ainos, the bear is honored by this peculiar people as a god. But it would be an error to suppose that the Ainos regard the bear as a god in the same sense as they do the God of Fire, for example, or any of their other numerous deities. The bear is called *Kimui; Kamui-Kamui* is an Aino word having about the same meaning as the Japanese *Kami*, and perhaps is derived from it. But the same word is used as an honorable appellation for foreign visitors, upon whom we can not possibly believe they would confer the attributes of a deity.

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[*] Der Bärencultus und die Bärenfeste des Ainos, mit einigen Bemerkungen über die Tänze derselben. Mittheilungen der Deutschen Gesellschaft für Natur- und Völkerkunde Ostasiens, Dec., 1880.

The Ainos have good reason to respect the bear. It is a most valuable animal, affording them food and clothing and a medicine, the bear-gall, which is greatly prized. On the other hand, it can do them great injury, as when it destructively enters their dwellings and kills their domestic animals. Therefore it is natural that they should seek to propitiate the bear, to confer upon him a title of great honor, and that they should consider an atonement necessary for putting him to death. They place the skull of the dead bear on the sacred hedge, the *nusha kamui*, which is found on the east side of every house, where it is held sacred and honored as a representative of the gods under the name *Kamui marapto*. The *nusha kamui*, god's fence, or sacred hedge, (Pl. CXII) is where the various gods are worshiped, except the God of Fire and the house-god, to which offerings are made at certain places within the house. The bear feast is named *iomante*. This ceremony, as well as the preliminary feeding and rearing of a young bear, has also the motive of an atonement to the whole bear tribe for the killing of its brothers and sisters.

At the end of winter a young bear is caught, placed in a cage (Pl. CXIII), and reared in the village. At first it is suckled by the wife of the captor, afterwards fed with fish. The bear festival usually takes place in September or October, by which time the young bear has grown so large and strong as to threaten to break the cage. The Ainos first endeavor to exculpate themselves before the gods for what they are about to undertake. Having rendered the bear every favor possible, they can no longer keep him in captivity; therefore it is necessary to kill him.

The man who gives the feast, assumes the expense thereof and invites his relatives and friends. Such a festival is, considering the poverty of the Ainos, very expensive, for enormous quantities of saké are consumed. Hence it is considered a great honor to give a bear feast. At the present time the bear feasts are becoming more and more infrequent. On the east coast, so far as I traveled (from Tomakomai to Volcano Bay), no bear feast had been held for several years. The same remark applies to the district around Mori, on Volcano Bay. I have generally seen caged bears only on the road from Urap to Oshamambe. In this region I found the Ainos least affected by culture. Here, in the small village of Kunnai, I spent the day, which will be the subject of the following description:

On the 10th of August of this year, about noon, I arrived at Kunnai, 3 "ri" from Oshamambe. The host, in whose house the bear feast was to be celebrated, met us with friendly greetings. The people all wore their best clothes which, indeed, when the unclean habits of the Ainos are considered, is not saying much. On festive occasions they frequently wear fine old Japanese garments. It is a comic picture to see a worthy old Aino in a long silk gown, richly decorated with embroidery, which may have served years before in the wardrobe of a Japanese singing or dancing girl, now indeed, with its faded colors and spots of dirt, showing but little of its original beauty. The older men wear a peculiar head-dress (Fig. 87) named *shaba umpe*, a kind of crown, worn only on great occasions. This is plaited of the bark of a wild vine and adorned with spiral shavings, bear's claws, vine tendrils, etc. Its dark color is due to the smoke, which fills every Aino hut at all times of day and year, and which, apart from the different odors and insects, makes a sojourn within very unpleasant. The women, also, among whom there was not a pretty face, far less a beautiful one, had put on their best, including necklaces and strings of beads. Some had silk dresses and one had a velvet head-cloth, with which the hair was bound over the forehead. The entire company, consisting of about thirty persons, was already assembled. After looking about, meeting the principal personages, and visiting the caged bear, we entered the hut, where the feast began with a solemn offering of saké.

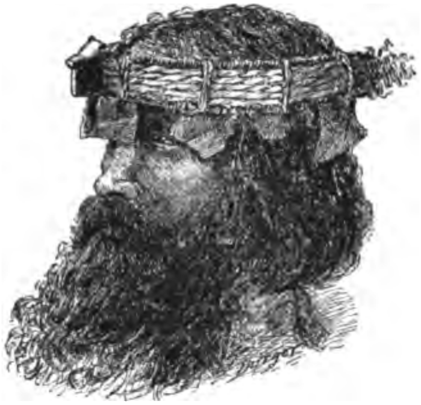

Fig. 87.
CEREMONIAL BARK HEAD-DRESS.

The house was cleaner and more orderly than any I have seen in the vicinity. The household treasures, principally old swords, sacred objects, ornaments, and drinking cups, were displayed along the north side. In the northeast corner, which is sacred to the house-god, new inao were stuck upon the wall.

The inao are sticks three-quarters of a metre in length, with spiral shavings attached (Fig. 86).

The kind of wood of which these are made differs in different localities. In the country from Mori to Oshamambe a kind of cornelian cherry is used (*Cornus brachypoda*, Jap. *mizu no ki*), while on the opposite side of Volcano Bay, at Mombetsu, and on the east coast of Mukawa and south, the willow* is used. These sticks or inao have the same meaning as the *gohei*† of the shinto temples of the Japanese.

Shavings of the same wood are attached to all sorts of objects, especially to such as are used on festive occasions. Inao were placed on the four corners of the bear cage. In the fire-place, in the middle of the hut, an inao was set up. Around the fire-place mats were spread, on which the company was seated. The host first made an offering of saké to the fire god, in which he was followed by the guests. Then another offering was made to the house god before the corner sacred to this god.

During the ceremony the Ainos, seated on the mats, first raise the drinking cup with the left hand to the forehead, while the right hand is somewhat raised with the palm upward. Then the moustache-stick, which has thus far rested across the top of the drinking cup (Fig. 77), is dipped into the saké and a few drops thrown into the fire, the stick being moved several times back and forth above the cup. At the same time a prayer is murmured. This ended, the saké is drunk in large draughts, while the moustache is held up with the stick. This ceremony not only takes place on festive occasions, but is carried out whenever saké is drunk. While the gods were receiving their offerings and the drinking vessels passed from hand to hand, many greetings were exchanged, and I was again made welcome by a long speech from the host.

Meanwhile the woman who had reared the bear was sitting at one side, very sad, at times in tears. Her sorrow was certainly not pretended. She also presented a drink offering, and two other old women did the same. The drinking ceremony of the women is much simpler than that of the men. They merely raise the wine cup once before drinking and pass the forefinger across the face, under the nose.

After the close of the ceremony in the house, offerings were made before the bear cage by the host and others. The bear also received several drops of saké in a shell, which he immediately turned over. Then began a dance of the women and young maidens before the cage (Pl. CXIV), which continued a long time, with short interruptions. With faces turned toward the cage, and slightly bent knees, rising on the toes and hopping up, they moved in a circle around the cage, clapping the hands and chanting a low, monotonous song of a few words oft repeated. The hostess and a couple of old women,—who may have reared many bears,—danced, with tears, and tenderly caressed the bear; but the young people laughed and sang. Bruin gradually became aroused by the noise around him, and began to jump about in the cage and set up a mournful howl.

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* I found the willow in almost universal use for inao throughout the greater part of the island.—R. H.

† The author is in error here. The gohei do not represent the gods. They are simply offerings, originally offerings of cloth, now represented by strips of cut paper. The inao seem to represent the god. There is no reason to suppose they are in any way related to the Japanese symbols.—R. H.

At the same time our attention was directed to another scene before the sacred hedge. The hedge was decorated with five new inao, to which leaves of bamboo were attached. The bamboo leaves signify that the dead bear may again come to life. Perhaps the evergreen color of the leaves, or the indestructible character of the bamboo, has led to its use here. In addition to this, swords and sacred quivers, known as *ikayup* or *ikor-kamui*, were suspended on the hedge. There were also bows and arrows, the latter always three in number, with which the bear was to be shot, and ear-rings and necklaces, to be laid on the bear after death. The men now found another opportunity to drink, and they made their drink-offerings before the sacred hedge. This time the Otena, or chief of Oshamambe, made the beginning. Three young men, who afterwards took the bear from the cage, each added two inao. Already there were noticeable signs of the industrious application of the drinking cup, and some men, hilarious with saké, began to dance before the hedge, with their hands raised to heaven to make their happiness known to the gods, and this became more frequent as the feast continued.

The bear was taken out of the cage by the bravest young Aino, assisted by two others. Donning a fine garment owned by the chief, he climbed to the top of the cage and removed the stones and top logs, and threw a rope around the neck of the bear. With this the bear was drawn out of the cage and led around for a time, that he might once more enjoy a sense of freedom before his death. Then he was made a target for the archers and shot with arrows which, instead of the pointed heads, bore blunt wooden ends decorated with bits of red cloth (Plate CXV).

Next the bear was taken before the sacred hedge, a piece of wood placed in his mouth, and he was crushed to death in a manner shown in the Japanese illustration (Plate CXVI). The poor animal died without a groan. The women danced around, with lamentations, and struck the men to manifest their indignation at such cruelty. The skin was then cut in the middle line of the belly. The bear was laid on a mat before the hedge, the sword and quiver from the latter hung about him, and food and drink were offered. A female bear is also decorated with necklaces and ear-rings. The food consisted of a plate of millet mush, another of millet cake made in the same manner as the Japanese *mochi*, with fish-oil poured over it, a can of saké with drinking cup, chopsticks and moustache-stick, the latter provided with spiral shavings.

The men then seated themselves before mats spread before the bear (Pl. CXVII), each with his drinking set before him, and began to make libations of saké and to drink unlimited quantities. It is the custom for the chief to begin this drink-offering, but he yielded the honor to the oldest man present. This man made the offering before the bear in the same manner as above described, using the drinking apparatus which was set before the bear. The others followed, and soon a good portion of the company was lying helplessly drunk upon the mats. The older men far excelled the younger in excessive drinking.

Turning now to the women, the sorrow which they, especially the older women, manifested when the bear was crushed, soon passed off and gave place to general hilarity which, since they did not despise the saké, increased at times to ecstacy. They gave themselves up to the pleasures of the dance, in which only short breathing spells were allowed.

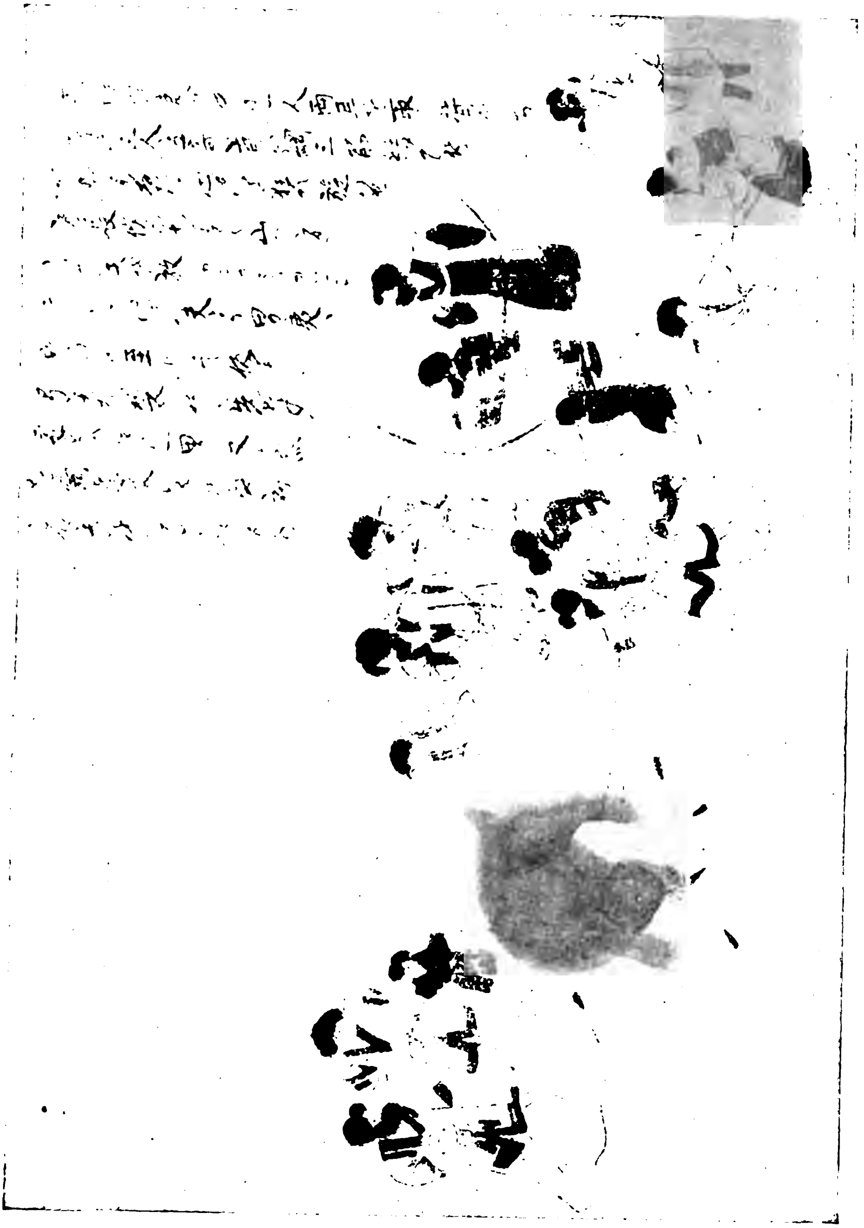
The older women showed themselves the more vigorous and wildest dancers.

Meanwhile the feast had reached its height, and the young men who had led the bear from the cage, mounted to the roof of a house in order to throw millet cake from a basket among the people.

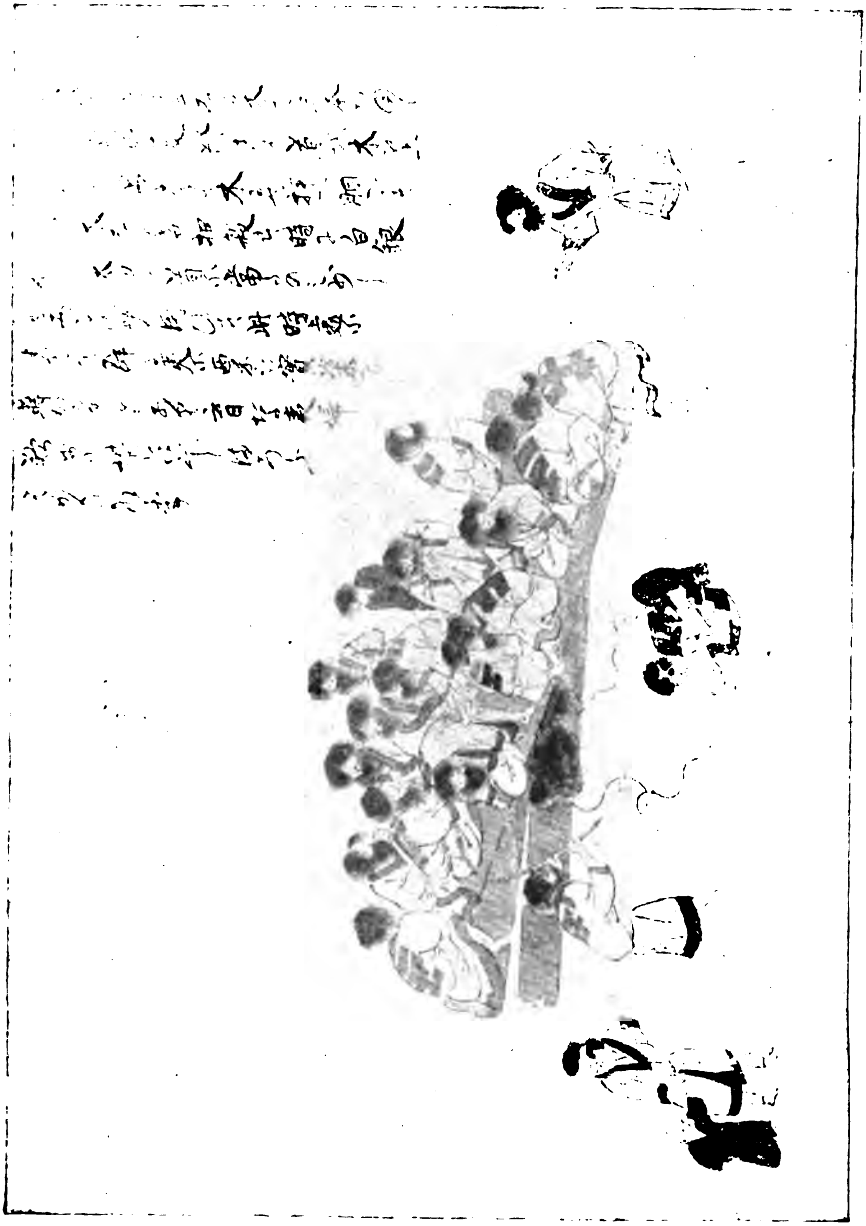
The bear is usually cut up on the following day, when the company again assembles to continue the drinking bout. After the animal is skinned and disemboweled, the legs and trunk are separated from the head, which remains in the skin. One of the young Ainos acted as butcher, while the others stood or sat around. The blood was caught by these in cups and greedily drunk. The liver was taken out, cut in small pieces, and eaten raw with salt. The flesh and other entrails were preserved in the house, to be divided among the participants in the feast on the following day. During this work the women danced around the sacred hedge, as they did around the cage at the beginning of the feast.

The bear's head, within the skin, was placed before the hedge and decorated in the same manner as the body was adorned before, one inao being added, and a general drink-offering was made. At the end of this the skin was drawn from the skull, leaving such as adheres to the snout and ears. In the left side of the back skull-bone of male bears, in the right side of females, an opening is made, through which the brains are removed. These are divided in the cups, mixed with saké, and drunk. The skull is then filled with shavings. The eyes were taken out and the orbital fat was bitten off and eaten by the young butcher. The eyes were wrapped in shavings and returned to their sockets. The mouth was stuffed with bamboo leaves and the skull decorated with shavings. The skull was again returned to the skin. and both, with sword, quiver, inao, and the piece of wood which the bear held in his mouth when he was crushed, were laid before the hedge. After another drink-offering the skull was raised upon a pole in the hedge, (Fig. 88,) which terminated in a forked end, and the entire company of men and women, singing and crying, danced before it. The pole had also an inao on either side of its upper forked end, and bamboo leaves attached. Beneath the skull, the piece of wood from the bear's mouth was fixed crosswise, and from it the sword and quiver were suspended. The two latter are usually removed in the course of an hour. A final

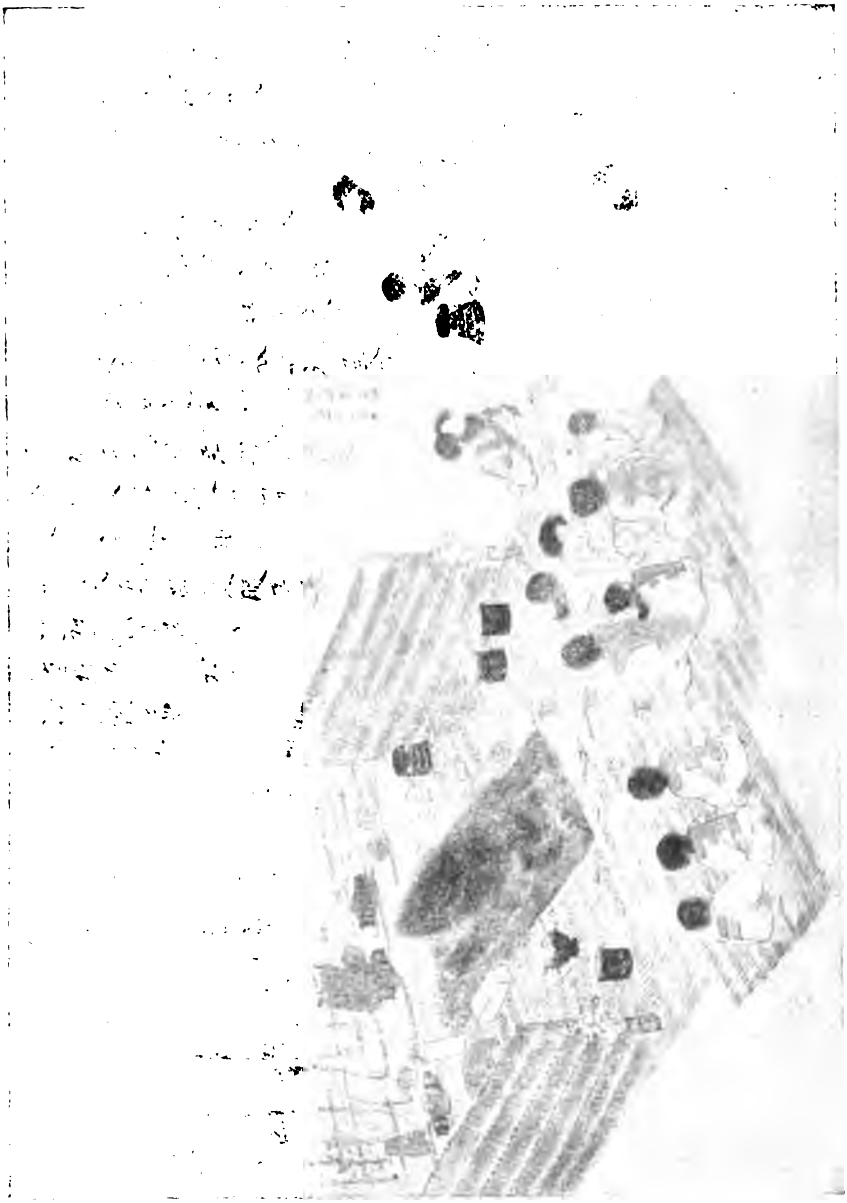
PLATE CXV.



SHOOTING THE BEAR.



CRUSHING THE BEAR.



OFFERINGS TO THE DEAD BEAR.

drink offering, in which the women also took part with renewed weeping, completed the ceremony. The manner of placing the head on the pole is shown in Fig. 88, which is copied from Dr. Scheube's drawing. The general appearance of the hedge is best seen in Plate CXII.

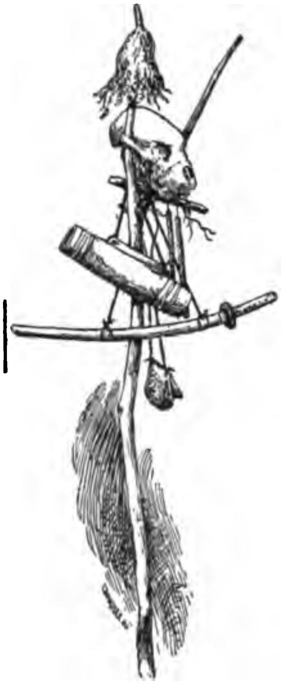


Fig. 88.
The Bear's Skull on the Sacred Hedge.

In the short account of the mythology and folk-lore of the Ainos given further on, there are some bear stories which are of interest in connection with the ceremonies described, indicating how the Ainos regard the animal in its relations to themselves. As Dr. Scheube has said, the bear is more to them than a mere beast of the forest, to be hunted and killed for food and raiment.

The Ainos are not the only people who worship the bear in the manner described above. In the northern part of Saghalien there are a people quite distinct in their physiognomy and language from the Ainos known as the Gilyaken.* Mr. W. Joest observed a bear feast among the Gilyaken, the description of which, as quoted by Dr. Scheube in a later communication, is substantially as follows. The mother bear is shot and the young one is caught and reared, but not suckled in the village. When the animal is large enough he is bound with a thong around the neck and another on one of his hind legs, and then led in triumph through the village. He must enter every house, where he receives food, while his manner of entrance and conduct are observed as omens. The bear is then for a time provoked, tormented, and annoyed until he is enraged and furious. The animal is then secured to a stake and shot dead with arrows. The head is then cut off and decorated with shavings corresponding to the inao of the Ainos, and placed upon the table upon which the feast is spread. The people then beg his forgiveness and offer prayers to him. They then eat the flesh roasted (not raw, as do the Ainos, nor do they drink the blood) with schnapps, but without any ceremonies. Finally the brain is eaten and the skull is placed with the shavings in a tree near the houses. Then follows dancing by both sexes in imitation of bears.

### DANCES AND OTHER CEREMONIES.

Allusion has been made here and there to singing and dancing. Dr. Scheube has given an account of the dances he saw, but it has not seemed desirable to treat this subject at length in this place, for the reason that there is so little known as yet concerning the significance of the Aino dances. The dancing is not graceful. In some instances it would seem that the dances are imitative of animals, as the bear dance and the crane dance mentioned by Mr. Blackiston, who when unaware of the name "was forcibly struck with the resemblance of the chanting used during the performance to the sounds uttered by cranes."

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* See Reisen und Forschungen in Amur-lande, Dr. L. Von Schrenck, vol. III, for an exhaustive account of these people.

A strange ceremony was once witnessed by Mr. Louis Boehmer among the Saru Ainos, which is thus quoted by Mr. Blackiston.

> The chiefs were dressed expressly for the occasion in handsome robes embroidered with blue, and wore crowns of straw decorated with red flannel and bits of tin. Within the lodge were Japanese gifts that had accumulated for perhaps a score of generations, old swords, rice dishes, and lacquered ware; the oldest much the best and very handsome, the newest nearly plain lacquer.
>
> The Ainos in drinking raised their heavy mustache with a small stick, somewhat like a paper cutter, made for the purpose and sometimes neatly carved. The next morning on the shore some of the Ainos made a prayer to the sea-god to quiet the swollen waves, and to send back two boats that had gone out each with two Ainos a couple of days before. The same day an Aino boat that went in search of them, brought back one boat, but the other seemed to be lost. The two rescued, but half starved men were fed on the seashore, and towards sunset there was a singular dance on the beach. The Aino men of the village formed one line and the women another, and with poles like lances in their hands went through many evolutions. Sometimes they would make as if charging with their lances against the sea. Then there was another prayer by an old man facing the sea. After sundown all hope for the other boat was given up, and according to custom the women in all of the neighboring five villages devoted themselves to lamentations, which they kept up the greater part of the night. They squatted in pairs on the ground, facing and hugging each other, and wailed and shed tears. The men did not join in the crying, and the women did not except while squatting.

There is also a harvest festival, which occurs in November, when much saké is consumed with singing and dancing. Both sexes join in most of the dances.

Some of the popular songs are given by Dr. Scheube, among which the following will bear translation:

> *Drinking song.*—I am chief in this village; thou art chief in another village. We do not know which of us is the wiser. In order to decide we must begin a strife of words together. This, however, does not go well with the drinking. Therefore we will content ourselves with the drinking.
>
> *Song of thanksgiving.*—I am very fortunate that I have received from you, most honored sir, such good eating and drinking.
>
> *Fisher song when a new boat is first used.*—The daughters of the master are beautiful, the old as well as the young. So beautiful will this boat also be.

## MYTHS AND FOLK-LORE.

The Ainos having been, as it may reasonably be supposed, more or less subjected to Japanese influences for a thousand years, it would be very strange if they had not borrowed something from the latter of their mythology and folk-lore. So indeed they have, but this influence has not been so strongly felt as might be expected, doubtless because the two peoples are so surprisingly different in character and in their ways of thinking.

The mythologies of the Japanese and Ainos are essentially distinct. After eliminating from the latter numerous stories, which are obviously imitations or adaptations of Chinese or Japanese tales, there remains a totally distinct series of narratives, handed down verbally from an unknown source and perhaps from a very distant age.

The mythology of the Japanese is a remarkable development of ancestral worship. The Mikado traces his descent to the sun, the common ancestor of the Japanese people. The system treats of the exploits of gods and heroes, the latter being elevated to places among the kamui to be revered and worshiped. There is scarcely a moral teaching in it. It is a kind of hero worship, but the hero may be a very wicked sinner.

The Aino myths, on the other hand, usually have a moral application. The Ainos have but few great heroes. The subjects of their tales are mostly beasts and birds. These are the gods of the Ainos, as well as the actors in his fairy-land. It would extend this report to an undue length to reproduce all the stories translated by Professor Chamberlain, Dr. Scheube and Mr. Batchelor, but some of them may well be given to indicate their general character. Dr. Scheube has given three quite interesting tales concerning the Japanese hero Yoshitsune, who is supposed to have visited the Ainos in the twelfth century, and to have taught them various useful things. There is also a strange story of a Japanese girl who was disobedient. Her father put her into a box and threw it into the sea. It was borne northward by wind and wave, and finally landed in Yezo, where the town Ishikari now stands. A dog came along and broke open the box with his teeth. The maiden was still alive. As she saw the dog she said to herself, "I have been disobedient to my father at home, therefore I have fared so badly. Here where there are only dogs I must obey them that I may not again be punished. In my earlier stage of existence it was predestined that I should marry a dog." So she married the dog and the two lived happily together, and she brought forth a child whose body was covered with long black hair, and other hairy children. These were the first Ainos. It is doubtful whether this is an Aino legend. It is more probably of Japanese origin.

The following stories are selected from the translations of Prof. B. H. Chamberlain and Mr. J. Batchelor:

### HOW IT WAS SETTLED WHO SHOULD RULE THE WORLD.

By Professor CHAMBERLAIN.

When the creator had finished creating this world of men, the good and the bad gods were all mixed together promiscuously, and began disputing for the possession of the world. They disputed—the bad gods wanting to be at the head of the government of this world and the good gods having a similar desire. So the following arrangement was agreed to: Whoever, at the time of sunrise, should be the first to see the luminary, should rule the world. If the bad gods should be the first to see it rise, then they should rule; and if the good gods should be the first, then they should rule. Therefore both the bad gods and the brilliant gods looked toward the place whence the sun was to rise. But the fox-god alone stood looking toward the west. After a little time the fox cried out, "I see the sun rise." On the gods, both good and bad, turning around and gazing, they saw in truth the refulgence of the sun in the west. This is the cause for which the brilliant gods rule the world.

## WHY THE COCK CAN NOT FLY.

By Professor CHAMBERLAIN.

When the Creator had finished making the world and had returned to heaven, he sent down the cock to see whether the world was good or not, with the injunction to come back at once. But the world was so fair that the cock, unable to tear himself away, kept lingering on from day to day. At last, after a long time, he was on his way flying back up to heaven. But God, angry with him for his disobedience, stretched forth his hand and beat him down to earth, saying: "You are not wanted in heaven any more." That is why, to this day, the cock is incapable of any high flight.

## ORIGIN OF CIVILIZATION.

By Professor CHAMBERLAIN.

When the world had only recently been made, all was still unsettled and dangerous, for the crust of the earth was thin. It was burning beneath, and unstable, so that the people did not dare venture outside of their huts even to obtain food, for they would have scorched their feet. Their necessities were relieved by the god Okikurumi, who used to fish for them, and then send his wife, Turesh, round with what he caught. She every day popped in at each window the family meal for the day. But the conditions of this divine succor was that no questions were to be asked, and that none should attempt to see Turesh's face. Well, one day a certain Aino, in one of the huts, not content with being fed for nothing, must needs disobey Okikurumi's commands. Curious to see who was the lovely ministering maiden, he watched for the moment when her hand with food in it appeared at the window, seized hold of it and forcibly pulled her in, disregarding her screams. No sooner was she inside the hut than she turned into a wriggling, writhing sea monster. The sky darkened, crashes of thunder were heard, the monster vanished, and the hut was consumed by lightning. In punishment of that one man's curiosity, Okikurumi withdrew his favor from the whole race and vanished. Ever since then the Ainos have been poor and miserable.

According to another tradition, which seems to be among those most widely spread, the Japanese hero Yoshitsune arrived on the scene some time after Okikurumi had begun teaching the Aino men how to fish and hunt, and Turesh had begun teaching the Aino women how to sew. Being of a wily disposition, he ingratiated himself so well with the divine pair that they bestowed on him their only daughter in marriage. The wedding took place at Piratori, in the district of Saru. Yoshitsune was thus enabled to penetrate the secrets of the Ainos. By a fraud, to which his wife was an unwilling partner, he obtained possession of their treasures and of their books and fled, carrying all with him. Okikurumi and Turesh, incensed at this insult, disappeared through a cavern at the summit of Mount Hayopira, near Piratori. Since that time the Ainos have lost the art of writing and of pottery, and have taken to buying their clothes, etc., from the Japanese. When interrogated on any point on which they are at a loss for an answer, the almost invariable Aino reply is, "We do not know, for we have no books. Those that our ancestors had were all stolen by Yoshitsune."

## A VISIT TO THE UNDERWORLD.

By Professor CHAMBERLAIN.

A handsome and brave young Aino, skillful in the chase, one day pursued a large bear into the recesses of the mountains. On and on ran the bear, and still the young fellow pursued it up heights and crags more and more dangerous, but without ever being able to get near enough to shoot it with his poisoned arrow. At last on a bleak mountain summit, the bear disappeared down a hole in the ground. The young Aino followed in, and found himself in an immense cavern, at the far extremity of which was a gleam of light. Toward this he groped his way, and, on emerging, found himself in another world. All was as in the world of men, but more beautiful. There were trees, houses, villages, human beings. With them, however, the young hunter had no concern. What he wanted was his bear, which had totally disappeared. The best plan seemed to be to seek it in the remoter mountain district of this new world underground. So he followed up a valley, and, being tired and hungry, picked the grapes and mulberries that were hanging on the trees, and ate them while walking leisurely along.

Suddenly, happening to look down on his own body for some reason or other, what was his horror to find himself transformed into a serpent! His very tears and cries on the discovery of the metamorphosis were changed into snake's hisses. What was he to do? To go back like this to his native world, where snakes are hated, would be certain death. No plan presented itself to his mind. But unconsciously he wandered, or rather crept and glided, back to the mouth of the cavern that led home to the world of men; and there, at the foot of a pine tree of extraordinary size and height, he fell asleep. To him then, in a dream, there appeared the goddess of the pine tree and said: "I am sorry to see you in this state. Why did you eat the poisonous fruits of Hades? The only thing for you to do, if you wish to recover your original shape, is to climb to the top of this pine tree and fling yourself down. Then you may, perhaps, become a human being again." On awaking from this dream the young man, or rather snake, as he found himself still to be, was filled half with hope, half with fear. But he decided to try the goddess' remedy. So gliding up the tall pine tree, he reached its topmost branch, and, after a little hesitation, flung himself down. Crash he went. When he came to his senses he found himself standing at the foot of the tree; and close by was the body of an immense serpent, all ripped open, so as to allow of his having crawled out of it. After offering up thanks to the pine tree and setting up divine symbols in its honour, he hastened to retrace his steps through the long tunnel-like cavern, through which he had originally come into Hades.

After walking for a certain time he emerged into the world of men, to find himself on the mountain top whither he had pursued the bear which he had never seen again. On reaching home he dreamt a second time. It was the same goddess of the pine tree who appeared before him and said: "I come to tell you that you can not stay long in the world of men after once eating the grapes and mulberries of Hades. There is a goddess in Hades who wishes to marry you. She it was who, assuming the form of a bear, lured you into the cavern and thence to the underworld. You must make up your mind to come away."

And so it fell out. The young man awoke, but a grave sickness overpowered him. A few days later he went a second time to the underworld, and returned no more to the world of the living.

## PANAUMBE PENAUMBE AND THE WEEPING FOXES.

By Professor CHAMBERLAIN.

There were Panaumbe and Penaumbe. Panaumbe went down to the bank of the river and called out: "Oh, you fellows on the cliff behind yonder cliff; ferry me across." They replied: "We must first scoop out a canoe. Wait for us." After a little while

Panaumbe called out again. "We have no poles," said they; "we are going to make some poles. Wait for us." After a little while longer he called out a third time. They replied thus: "We are coming for you. Wait for us." Then the boat started—a big boat, all full of foxes. So Panaumbe, having first seized hold of a good bludgeon, feigned dead. Then the foxes arrived and spoke thus: "Panaumbe, you are to be pitied. Were you frozen to death, or were you starved to death?" With these words all the foxes came up close to him and wept. Thereupon Panaumbe brandished his bludgeon, struck all the foxes and killed them. Only one fox did he let go, after breaking one of its legs. As for the rest, having killed them all, he carried them home to his house and grew very rich [by selling their flesh and skins].

Then Penaumbe came down to him and spoke thus: "Whereas you and I were both equally poor, how did you kill such a number of foxes and thereby become rich?" Panaumbe replied, "If you will come and dine with me, I will instruct you." But Penaumbe at once said, "I have heard all about it before," and went out. Descending to the bank of the river, he called, crying out as Panaumbe had done. The reply was: "We will make a boat at once. Wait for us."

After a little while he called out again. "We are going to make the poles. Wait for us," said they. After a little longer they started a whole boat full of foxes.

So Penaumbe first feigned dead. Then the foxes arrived and said: "Penaumbe here is to be pitied. Did he die of cold, or did he die from want of food," with which words they all came close to Penaumbe and wept. But one fox among them—a fox who limped—spoke thus: "I remember something which once happened. Weep at a greater distance." So all the foxes sat and wept further and further away.

Penaumbe was unable to kill any of those foxes, and as he brandished his bludgeon they all ran away. Not one did he catch, and he himself died a lamentable death.

## THE HARE GOD.

By Professor CHAMBERLAIN.

Suddenly there was a large house on top of a hill, wherein were six persons beautifully arrayed, but constantly quarreling. Whence they came was not known. Thereupon Okikurumi came and said: "Oh, you bad hares. You wicked hares. Who should not know your origin? The children in the sky were pelting each other with snowballs, and the snowballs fell into this world of men. As it would have been a pity to waste heaven's snow, the snowballs were turned into hares, and those hares are you. You who live in this world of mine, this world of human beings, must be quiet. What is it that you are brawling about? ' With these words Okikurumi seized a firebrand and beat each of the six with it in turn. Thereupon all the hares ran away. This is the origin of the hare god, and for this reason the body of the hare is white, because made of snow, while its ears, which are the part which was charred by the fire, are black.

## THE WICKED WIZARD PUNISHED.

By Professor CHAMBERLAIN.

One day a wizard told a man whom he knew that if any one were to go up a certain mountain peak and jump off to the belt of clouds below, he would be able to ride about on them as on a horse and see the whole world. Believing this, the man did as directed, and in very truth was enabled to ride about on the clouds. He visited the whole world in this fashion, and brought back with him a map which he had drawn of the whole world, both of men and gods. On arriving back at the mountain-peak in Aino land, he stepped off the cloud on to the land, and, descending to the valley, told the wizard how successful and delightful the journey had been, and thanked him for the opportunity he had given him of thus seeing so many strange sights.

The wizard was astounded, for what he had told the Aino was a wicked lie, invented with the sole intention of causing the death of the man, whom, for reasons best known to himself, he hated. Still, as that which he had meant as an idle tale was apparently an actual fact, he decided to see the world himself in this fashion. So, going to the top of the mountain and seeing a belt of clouds a short way below, he jumped on to it, but was simply smashed to pieces in the valley beneath. That night the god of the mountain appeared to the first (good) man in a dream and said, "The wizard has met with the death which his fraud and folly deserve. You I kept from hurt because you are a good man. So when, in obedience to the wizard's advice, you leapt off onto the cloud, I bore you up and showed you the world in order to make you wiser. Let all men learn from this how wickedness leads to condign punishment."

## LEGEND OF A FAMINE.

By Mr. John Batchelor.

There was a woman who was ever sitting by the window and doing some kind of needlework or other.

In the window of the house there was a large cup filled to the brim with wine, upon which floated a ceremonial moustache-lifter.

The ceremonial moustache-lifter was dancing about upon the top of the wine cup. In explaining the subject from the beginning and setting it forth from the end, the tale runs as follows:

Now look, do you think that the great god, do you think that the true god, was blind?

In Ainu land there was a great famine and the Ainu were dying for want of food, yet with what little rice-malt and with what little millet they had they made (a cup of) wine.

Now the great god had mercy, and, in order that our relatives might eat, produced both deer and fish.

And the great god had mercy upon us, therefore he looked upon us and, in truth, saw that in Ainu land there was a famine, and that the Ainu had nothing to eat. Then was that cup of wine emptied into six lacquer-ware vessels.

In a very little while the scent of the wine filled the whole house.

Therefore were all the gods led in and the gods of places were brought from everywhere, and they were all well pleased with that delicious wine.

Then the goddess of the rivers and the goddess of the mouths of rivers danced back and forth in the house.

Upon this the gods laughed with smiles upon their faces;

And while they looked at the goddesses they saw them pluck out two hairs from a deer;

And, as it were, blew them over the tops of the mountains; then appeared two herds of deer skipping upon the mountain tops, one of bucks and the other of does.

Then they plucked out two scales from a fish, and, as it were, blew them over the rivers; and the beds of the rivers were so crowded with fish that they scraped upon the stones, and the tops of the rivers were so full that the fish stood out like the porches of houses and were dried up by the sun.

So the things called fish filled all the rivers to the brim.

Then the Ainu went fishing and caused their boats to dance upon the rivers.

The young men now found fish and venison in rich abundance.

Hence it is that Ainu land is so good. Hence it is that from ancient times till now there has been hunting. Hence it is that there are inheritors to this hunting.

## LEGEND OF THE LARGE TROUT.

By Mr. John Batchelor.

At the source of the Saru River there is a large lake.

In this lake there was a monster trout which was so big that it used to flap its (pectoral) fins at one end and wave its tail at the other.

Then the honorable ancestors met and went to kill this fish, but found themselves unable to accomplish their end, though they attempted to do so for many days.

Because then they very much desired to kill the fish, the gods, who had a special regard for the welfare of Ainu land, sent help from heaven.

And the gods descending, they seized the great trout with their hands (claws).

Upon this it plunged mightily and went to the bottom of the lake with great force.

Then the gods put forth all their power, and, drawing the great trout to the surface of the water, brought it ashore.

Upon this all the honorable ancestors drew their swords and chopped the fish till they quite killed it.

The Ainu appear to have a special dread of large lakes, because they say that every now and again one of the monster fish suddenly puts in an appearance and commences its destructive work of swallowing animals and human beings. Only a few hundred years ago, they say, one of these awful fish was found dead upon the shores of the Shikot-tō (Chitose Lake). This monster had swallowed a large deer, horns and all, but the horns caused a severe attack of indigestion to come on, which the fish could not get over; nay, the horns were so long that they protruded from its stomach and caused its death.

It is to the actions of one of these monstrous fish that all earthquakes, of which there are many occurrences in Yezo, are to be traced. The earth, *i. e.*, so far as Ainu land is concerned, is supposed to rest upon the back of one of these creatures; and whenever it moves, the world, as a matter of course, must feel the effects and move also. This earthquake-causing fish is sometimes called Tokushish, *i. e.*, "trout," and sometimes Moshiri ikkewe chep, *i. e.*, "the backbone fish of the world."

## LEGEND OF OKIKURUMI IN LOVE.

By Mr. John Batchelor.

The goddess felt lonely and gazed upon the inside and surveyed the outside of the house.

She went out, and behold,

The clouds were floating and waving about in beautiful terraces upon the horizon over Ainu land. Yes, that is what she saw.

So she returned into the house backwards and took down the needlework.

Again she looked at the point of her needle and fixed her gaze upon the eye end thereof.

Then came a little bird, called "water wagtail," and sat upon the window shutter and wagged its tail up and down and waved it from right to left.

Then two chirps and three chirps came to her and touched the inside surface of her ears, and what she heard was this:

The mighty Okikurumi, who is the governor of all Ainu land, went out of doors for a little while and, seeing you, has fallen ill of love on your account.

And though two bad fish and two good fish were placed before him for food he refused to eat.

Now, if Okikurumi should die, the soul of Ainu land will depart.

Then the little bird called "water wagtail," waving its tail, spake two words to her and said: "Have mercy upon us, that Okikurumi may live."

Thus then, by simply looking out upon the world, Okikurumi fell so sick of love that, though two bad fish and two good fish were set before him, he could not eat.

Dear, dear, how badly he felt.

Therefore the form of a woman resembling the goddess was made and sent down to Okikurumi.

The house was set in order; that woman who was sent down put things to rights.

Then Okikurumi looked through his sleeve and saw the beautiful woman.

He got up greatly rejoicing; he ate some food; strength came back to his body, and—the woman was gone.

Okikurumi saw he had been deceived, but there was nothing to be done and nothing to say; so he got well.

## POIYAUMBE.

By Mr. John Batchelor.

We three, my younger sister, my dear brother, and I, were always together.

One night I was quite unable to sleep; but, whether what I now relate was seen in a dream or whether it really took place, I do not know.

Now I saw upon the tops of the mountains, which lie towards the source of our river, a great herd of male deer feeding by themselves. At the head of this great herd there was a very large speckled buck; even its horns were speckled. At the head of the herd of female deer there was a speckled doe skipping about in front of its fellows. So I sat up in my bed, buckled my belt, winding it once around my body, and tied my hat strings under my chin. I then fastened my leggings, made of grass, to my legs, slipped on my best boots, stuck my favorite sword in my girdle, took my quiver sling in my hand, seized my bow, which was made of yew and ornamented with cherry bark, by the middle, and sallied forth.

The dust upon the road by the river side was flying about. I was taken up by the wind and really seemed to go along upon the clouds. Now, my elder brother and younger sister were coming along behind me.

And as we went along, in truth, we saw that the mighty mountains were covered with great herds of bucks and does; the bucks had a speckled male at their head, even its horns were speckled; there was also a speckled female deer skipping about at the head of the does.

On coming near them I took an arrow out of my quiver and shot into the thickest of the herd, so that the mountains became covered with the multitude of those which had tasted poison (*i.e.*, which had been hit with poisoned arrows). And my older brother, shooting into the thickest of the herd of does, killed so many that the grass was completely covered with their bodies; within a very short time the whole herd, both of bucks and does, was slain. How was it that that which but a short time since was a deer became a man? That I can not tell.

With angry words he said to me: "Because you are a brave Poiyaumbe and your fame has spread over many lands, you have come hither with a purpose of picking a quarrel with me, but, however brave you may be, I think you will probably find that you are mistaken."

When he had spoken so much, this lordly person drew his sword with a flash and struck at me with powerful strokes; in return I also flashed out my sword, but when I hit at him with mighty blows there was no corresponding clashing sound. It was extremely difficult to come upon him; it was as though the wind caught the point of my sword. Though this was the case, though it was difficult to strike him, and though I did not realize that I was struck, yet much blood spurted out of my body. That abominable bad man was also bleeding profusely.

Whilst things were going on in this way, my elder brother and younger sister met with the speckled doe and both attacked it with drawn swords. With great fear they fought; and when I looked I saw that my elder brother was cut in twain; as he fell he put out his hands and raised himself from the earth. I then drew my sword and cut him twice or thrice, so that he became a living man again. Then riding upon a sound like thunder, he quickly ascended to the skies and again engaged in the fight. I now heard a sound as of another person being slain elsewhere; it was my younger sister who was killed. With a great sound she rode upon the sun (*i. e.*, she died with a groan). Upon this the bad foreign woman boasted, and said that she had slain my younger sister and thrown her to the earth. Then the two, the woman and man, fell upon me with all their might and main, but I struck the bad woman twice or thrice, so that she rode upon the sun; she went to the sun a living soul. Then the bad, malignant man, being left alone, spoke thus: "Because you are a Poiyaumbe and the fame of your bravery has spread over many countries, and because you have done this, know ye that the place where I live is called Samatuye. The two, my younger brother and sister, are the defenders of my house, and they are exceedingly brave. Thus, then, if I am slain by you, my younger brother will avenge my death and you will live no longer. You must be careful."

Now I made a cut at that bad, malignant man, but he returned the blow, and I swooned. Whether the swoon lasted for long space or a short, I know not; but when I opened my eyes I found my right hand stretched out above me and striking hither and thither with the sword, and with the left I was seizing the grass and tearing it up by the roots.

So I came to myself. And I wondered where Samatuye could be and why it was so called. I thought that name was given to the place to frighten me, and I considered that if I did not pay it a visit I should be laughed at when I returned home, and thus feel humiliated.

Therefore I looked up and discovered the track by which this multitude of persons had come. I ascended to the path and passed very many towns and villages. And I traveled along this path for three days and three nights, in all six days, till I came down upon the seashore; here I saw many towns and villages.

Here there was a very tall mountain, whose top extended even into the skies: upon its summit was a beautiful house, and above this circled a great cloud of fog. I descended by the side of the house, and, stealthily walking along with noiseless steps, peeped in between the cracks of the door and listened. I saw something like a very little man sitting cross-legged at the head of the fireplace staring into the fire, and I saw something like a little woman sitting on the left-hand side of the fireplace.

Here again was a woman who in beauty excelled my younger sister. Now, the little man spoke thus: "Oh, my younger sister, listen to me, for I have a word to say. The weather is clouding over and I am filled with anticipation. You know you have been a prophet from a child. Just prophesy to me, for I desire to hear of the future."

Thus spake the little man. Then the little woman gave two great yawns and said: "My elder brother, my little elder brother, listen to me, for I have a word to say. Wherefore is my brother thus in anticipation? I hear news from a distant land: this is news coming from above the mountain of Tomisanpet. The brave Poiyaumbe have been attacked by my elder brother without cause, but a single man has annihilated my brother and his men. Whilst the battle proceeds a little Kesorap comes flying across the sky from the interior; and, though I earnestly desire to prophesy about it, some how or other it passes out of my sight. When it crosses the sea it darts along upon the surface of the water like a little fish; coming straight towards our town is the clashing of swords, the sword of a Ya un man and a Rep un man: blood is squirting forth from two great wounds; the sword of the Rep un man goes in to the setting sun and is lost; the handle of the sword of the Ya un man shines upon the sun. Although our house was in peace it is now in danger. In speaking thus much my eyes become darkened. Pay attention to what I have said."

As she said this, I pretended that I had but now arrived, and knocking the dirt off my boots upon the hard soil just outside the house I lifted the doors creen over my shoulders and stepped inside. They both turned round and looked at me with one accord; with fear they gazed at me from under their eyebrows. Then I walked along the left-hand side of the fireplace with hasty strides.

I swept the little man to the right-hand side of the fireplace with my foot, and sitting myself cross-legged at the head thereof, spake thus: "Look here, little Samatuye man, I have a word to say; attend well to me. Why has your elder brother, the Samatuye man, attacked us without reason? Has he not done so? As you have stirred up this war without reason, you will be punished by the gods; you will be annihilated. Listen to what I have to say. Besides, although I am a wounded man, I will overthrow your town. Listen to what I say." And when I had said so much, I drew my sword and flashed it about. I struck at him with such blows that the wind whistled. We ascended to the ceiling fighting, and here I chased him from one end of the house to the other. Whilst this was going on, a very great multitude of men congregated upon the threshold. They were as thick as swarms of flies; so I cut them down like men mow grass.

Whilst this was going on the little woman said: "Oh, my brothers, why did ye commit such a fault as to attack the Poiyaumbe without cause? Was it that ye desired to slay those who had no desire to die that ye fell upon them? Henceforth I shall cast in my lot with the Poiyaumbe. Listen to my words."

When the little woman had thus spoken, she drew a dagger from her bosom and cut down the men at the door like grass; we fought side by side. Fighting so, we drove them out of the house, and when we looked at them, there were but a few left, but behind them stood the little Samatuye man; yes, he was there. In a very short time those few persons were all killed. After this I went after the Samatuye man with hasty strides, and drew my sword above him. I struck at him with heavy blows. The Samatuye woman also stood by my side and hit at her brother with her dagger.

In a short time he received two or three cuts and was slain. After this the little woman wept very much, and spake, saying: "As for me, I am undone. I did not desire to draw my dagger against a man without friends. As the little hawks flock together where there is food, so have I an earnest desire to be with thee, oh Poiyaumbe. Listen to what I say."

## AN AINO RIP VAN WINKLE.

In conclusion comes the story of Rip Van Winkle, told in so many forms by so many peoples. It should be compared with the legend of the fisher-boy Urashima and his Pandora's box, which Professor Chamberlain has so well rendered in verse from the Japanese. The translation of this Aino version is also by the same pen.

A certain Aino went out in a boat to catch fish in the sea. While he was there a great wind arose, so that he drifted about for six nights. Just as he was like to die, land came in sight. Being borne on to the beach by the waves, he quietly stepped ashore, where he found a pleasant rivulet. Having walked up the bank of this rivulet for some distance, he descried a populous town, in whose neighborhood were crowds of people, both men and women. Proceeding to the town itself, he found an old man of divine aspect, who said to him: "Stay with us a night and we will send you home to your own country to morrow. Do you consent?"

So the Aino spent the night with the old chief, who next morning addressed him as follows: "Some of my people, both men and women, are going to your country for purpose of trade. So, if you will put yourself under their guidance, you will be able to go home. When they take you with them in the boat you must lie down and not look about you, but completely hide your head. That is the condition of your return. If you look, my people will be angry. Mind you, do not look." Thus spoke the old chief. Well, there was a whole fleet of boats, inside which crowds of people, both men and women, took passage. There were as many as five score boats, which all started off together. The Aino lay down inside one of them and hid his head, while the others made the boats go to the music of a pretty song, which he much enjoyed. After a while they reached the land. When they had done so the Aino, peeping a little, saw that there was a river, and that they were drawing water with dippers from the mouth of the river and sipping it. They said to each other, "How good this water is." Half the fleet went up the river. But the boat in which the Aino was, continued its voyage, and at last arrived at the shore of his native place, whereupon the sailors threw the Aino into the water. He thought he had been dreaming, and then he came to himself. The boat and its sailors had disappeared; whither he could not tell. But he went to his house, and, falling asleep, dreamt a dream. He dreamt that the same old chief appeared to him and said: "I am no human being; I am the chief of the Salmon, the divine fish. As you seemed in danger of perishing in the waves, I drew you to me and saved your life. You thought you only staid with me a single night. But in reality that night was a whole year, at the conclusion of which I sent you back to your native place. So I shall be truly grateful if henceforth you will offer liquor to me, set up the divine symbols in my honor, and worship me with the words, 'I make a libation to the chief of the salmon, the divine fish.' If you do not worship me, you will become a poor man. Remember this well." Such were the words which the divine old man spoke to him in his dream.

## LIST OF SPECIMENS FROM THE AINOS IN YEZO, COLLECTED DURING THE SUMMER OF 1888.

By Romyn Hitchcock.

[The numbers refer to the entries in the register of the U. S. National Museum.]

*Mat.*—Made of the rush *Scirpus maritimus*, the *suge* of the Japanese, with black or brown colored squares of dyed bark of *Tilia cordata*. The elm bark is also used for the colored parts. The brown color is obtained from the bark of *Æsculus turbinata*, the black from *Alnus maritima*. Ainos of Yezo, 1888. 150632.

*Mat.*—Same as 150632. Ainos of Yezo, 1888. 150633.

*Mat.*—Same as 150632, different pattern. Ainos of Yezo, 1888. 150634.

*Mat.*—Same as 150632, different pattern. Ainos of Yezo, 1888. 150635.

*Mat.*—Same as 150632, different pattern. Ainos of Yezo, 1888. 150636.

*Shoes made of fish skin.*—Worn with snow-shoes in winter. (See Pl. XCVII.) Ainos of Yezo, 1888. 150637.

*Quiver and poisoned arrows.*—Arrows with iron heads, poisoned with a preparation of aconite root; used to kill bears. Ainos of Yezo, 1888. 150638.

*Quiver and poisoned arrows.*—Arrows with bamboo heads, poisoned with a preparation of aconite root. The shafts made in sections of reed and wood, with feathered ends. Ainos of Yezo, 1888. 150639.

| | Inches |
|---|---|
| Length of bamboo head | 1¾ to |
| Length of upper shaft of wood | 5¼ to 6 |
| Length of lower shaft of reed | 12¼ to 13 |

Stone arrow heads were probably in use by the Ainos within the historic period. They are found buried on the soil near the surface in many places.

*Bow.*—Made of the wood of *Taxus cuspidata*, which is preferred for the purpose. The specimen is 49 inches in length. The string is twisted bark cord. (See Fig. 84.) Ainos of Shari, Yezo, 1888. 150640.

*Bow.*—Similar to 150640, but 52 inches long. Ainos of Yezo, 1888. 150641.

*Bow.*—Small bow of wood wrapped with strips of bark to strengthen it. The string is secured at one end to a piece of hard wood fitting over the end of the bow like a cap, held in place by a wooden pin. Ainos of Yezo, 1888. (See Fig. 84.) 150642.

*Snowshoes.*—Made of wood with thongs of bear skin. These are worn with the shoes of fish-skin [No. 150637] or with much more comfortable boots made of hide and fur. (See Pl. XCVII.) Ainos of Bekkai, Yezo, 1888. 150643.

*Sandals.*—Shutukeri. Very rudely made of walnut bark, secured to the foot with cords of bark. (See Pl. XCVII.) Ainos of Piratori, Yezo, 1888. 150644.

*Leggins.*—"Hos." Made of Japanese blue cotton cloth, embroidered with cotton yarn. Lined with white cotton cloth. Ainos of Yezo, 1888. 150645

*Leggins.*—"Hos." Made of Japanese white striped cotton cloth bound with blue-black and embroidered on the latter with light-blue yarn. Ainos of Piratori, Yezo, 1888. 150646

*Leggins.*—"Hos." Made of ohiyo, elm-bark cloth, bound with Japanese black cotton cloth. Ainos of Piratori, Yezo, 1888. 150647

*Leggins.*—"Hos." Made of ohiyo, elm-bark cloth, embroidered with cotton. Ainos of Piratori, Yezo, 1888. 150648

*Leggins.*—"Hos." Made of Japanese cotton cloth, embroidered. Ainos of Yezo, 1888. 150649

*Ball of Ohiyo thread.*—Made by splitting the bark of the elm tree, *Ulmus montana*, and tying the ends of the filaments together. Used for weaving cloth for coats, leggins, belts, etc. Ainos of Piratori, Yezo, 1888. 150650

*Braided cord.*—Made of the bark of shina-no-ki, *Tilia cordata.* Ainos of Piratori, Yezo, 1888. 150651

*Bark.*—Called tamunki-no-kawa. Apparently it is the common ohiyo bark. Ainos of Abashiri, Yezo, 1888. 150652

*Dyed bark.*—Bark of *Tilia cordata* (Jap. shina-no-ki). Much used for the colored parts of mats, carrying bags, etc. The brown color is produced by soaking the bark in water with bark of *Æsculus turbinata*, the black in the same manner with *Alnus maritima.* Ainos of Uragawa, Yezo, 1888. 150653

*Linden bark.*—Bark of *Tilia cordata.* Much used for cords, fish nets, etc., and for the colored parts of mats. Ainos of Uragawa, Yezo, 1888. 150654

*Branches of the Linden.*—The wood from which the bark is stripped for making cords, etc. Ainos of Yezo, 1888. 150655

*Straw bag.*—A small bag, about 12 inches by 9, very rudely made. Used for gathering roots and other articles for food. Ainos of Uragawa, Yezo, 1888. 150656

*Small bag.*—Made of the rush *Scirpus maritimus*, the top bound with blue and white cotton cloth, of which the handle is also made. About 6 inches square. Ainos of Uragawa, Yezo, 1888. 150657

*Ohiyo branches.*—Small branches of the ohiyo tree, *Ulmus montana*, the bark of which is used for making the native cloth. Ainos of Piratori, Yezo, 1888. 150658

*Ohiyo coat.*—The usual form of garment, patterned after the Japanese. Made of ohiyo, elm-bark cloth, bound all around with blue-black Japanese cotton cloth. Not embroidered. Ainos of Yezo, 1888. 150659

*Ohiyo coat.*—Similar to 150659. The cloth has narrow longitudinal stripes of white cotton yarn. Not embroidered. Ainos of Yezo, 1888. 150660

*Ohiyo coat.*—The usual form of garment, elaborately embroidered in characteristic patterns. The body of the garment is made of elm-bark cloth, over which Japanese blue-black cotton is stitched in parts, and on this the pattern is embroidered. Such coats are only worn on special occasions. Ainos of Yezo, 1888. 150661

*Fish spear.*—A small spear with the shaft cut short. A curved, hook-like piece of iron fits loosely in the side of the shaft, attached to a cord which passes through the shaft, near the end. When a fish is struck the iron turns over, hooks into the flesh, and hangs by the rope. Ainos of Piratori, 1888. (See Fig. 85.) 150662

*Saké cup, stand, and stick.*—Made of lacquered wood by the Japanese. A form in universal use among the Ainos for drinking Japanese saké, of which they drink great quantities whenever they can get it. The stick resting on top of the cup (150664) is used to throw drops of the liquor as offerings to the gods, and to raise the moustache while drinking. Ainos of Yezo, 1888. (See Fig. 77.) 150663

*Moustache stick.*—Used to make libations of saké to the gods, and also to raise the moustache while drinking saké. Ainos of Yezo, 1888. (See Fig. 77.) 150664

*Ohiyo cloth.*—Woven of the bark of the ohiyo or mountain elm, *Ulmus montana*, with stripes of blue and bright colored cotton. A very strong durable cloth which has been in universal use by the Ainos, but which is now being replaced by the more comfortable Japanese cotton fabrics. Width, 13 inches. Ainos of Yezo, 1888. 150665

*Loom.*—With warp of elm bark and a small piece of cloth woven, showing the reed, shuttle, beater, etc. Weaving is usually done by the women, who sit on the floor and stretch the warp from the beams of the house. (See Fig. 82.) A similar loom arranged for use is shown in the section of textiles. Ainos of Yezo, 1888. 150666

*Ohiyo belt.*—Belt woven of elm bark on a small loom made for the purpose. Used as a belt outside the coat. Length, 8 feet; width, 1 inch. Ainos of Shari, Yezo, 1888. 150667

*Bark water bucket and dipper.*—Made of birch bark. Used for holding water. (See Fig. 73.) Ainos of Yezo, 1888. 150668

*Bark basket.*—Made of ohiyo bark with handle of the same bark twisted. Ainos of Piratori, Yezo, 1888. 150669

*Wooden ladle.*—"Kasup." A large ladle used for dipping food from the kettle. Ainos of Piratori, Yezo, 1888. 150670

*Ohiyo belt.*—Made of the ohiyo or elm bark, with stripes of colored cotton. Ainos of Yezo, 1888. 150671

*Conical bark bag.*—Made of the bark of the linden tree. Ainos of Piratori, Yezo, 1888. 150672

*Bark dish for fish.*—Very rudely made by binding the bark into the form of a deep dish and tying the ends with bark rope between short sticks to preserve the shape. Ainos of Piratori, Yezo, 1888. 150673

*Bark dipper.*—Made of birch bark, with a wooden handle. Ainos of Piratori, Yezo, 1888. 150674

*Spear.*—A two-pronged spear used for spearing seals or large fish, salmon, etc. The two points of sheet iron, sharpened, are set in barb-shaped pieces of hard wood, which fit loosely over the ends of the prongs of the shaft, and are held in place by the tension of the bark rope, to which they are securely attached. When the weapon strikes the barbs enter the flesh and become detached from the shaft, but they are securely held by the line until the animal is killed or exhausted. The points are sometimes poisoned. (See Fig. 85.) Ainos of Abashira, Yezo, 1888. Length of shaft 15 feet. 150675

*Small bag.*—Made of the rush *Scirpus*, with a cord to swing over the shoulder. Ainos of Yezo, 1888. 150676

*Ohiyo bark.*—The bark of the mountain elm, *Ulmus montana*, used principally for making cloth for clothing. The specimens show how the bark readily splits into numerous thin, broad bands or layers, from which long, narrow threads for weaving are drawn, tied end to end, and wound into balls like 150650. Ainos of Yezo, 1888. 150677

*Dried salmon.*—Fish cut into long strips and dried over the smoky fire in the house. Ainos of Shari, Yezo, 1888. 150678

*Carrying band.*—A braided band of ohiyo, used for carrying children and loads on the back. The broad middle part is placed on the forehead, and the ends tied under the burden on the back. Three specimens. (See also 150757.) Ainos of Yezo, 1888. 150679, 150680, 150681

This system of carrying children and loads is universal. The women carry large wooden tubs of water on their backs in this manner. (See Plate CV.)

*Tobacco pipe.*—A pipe 3 feet in length, the usual form, but of very unusual size. Ainos of Yezo, 1888. 150681

*Hoe.*—Fashioned from a branch of a tree, the blade being formed by sharpening the stub of the main branch. An extremely rude instrument. Ainos of Yezo, 1888. 150682

*Carrying bag.*—Similar to 150676, but larger, made of the rush *Scirpus*, with brown parts of dyed bark, the ends of ohiyo cloth. Ainos of Yezo, 1888. 150684

*Wooden dish.*—Octagonal in shape, about 12 inches wide by 2¼ inches deep inside, cut out of a single block of wood. Ainos of Yezo, 1888. 150685

*Wooden bowl.*—Circular, excavated from a block of wood, about 10 inches in diameter by 3 inches deep. Ainos of Yezo, 1888. 150686

*Cloth mitts.*—Mittens made of Japanese cotton cloth. They cover the wrist and back of the hands only. Ainos of Yezo, 1888. 150688

*Ceremonial head dress.*—A band of dyed bark, braided, about 2 inches wide, to put on the head. Around the outside a band of white, curled shavings pass, with the free ends behind. In front a rude wooden figure, perhaps representing the head of a bear. Squares of purple cloth hang down all around the lower edge. Used by the men when dancing. (See Fig. 87.) Ainos of Piratori, Yezo, 1888. 150687

*Apron.*—Made of ohiyo cloth and Japanese blue cotton cloth, embroidered with light-blue cotton yarn. Worn by the women. Ainos of Abashiri, Yezo, 1888. 150689

*Inao.*—A whittled stick made of willow wood with long, curled shavings hanging down from near the upper end. The lower end sharpened to stick in the ashes of the fire-place or in the ground. Rather more than half way up a few shavings curling upwards on one side. Length, 30 inches. Inao represents the gods, to which prayers are offered. They are found in every house in the corner sacred to the house god, and in the fire-place where the fire god is worshipped. (See Fig. 86.) Ainos of Yezo, 1888. 150690

*Inao.*—A whittled willow stick with pendant shavings, like 150690, but smaller, and stick plain below with short, curled shavings at the top. Length, 17 inches. Ainos of Yezo, 1888. 150691

*Inao.*—A willow stick with pendant shavings, similar to 150690 and 150691, and used for the same purposes. Length, 30 inches. Ainos of Yezo, 1888. 150692

*Broiling sticks.*—Stuck in the ashes of the fire-place with fish spitted upon them for broiling. Ainos of Yezo, 1888. 150693

*Tobacco box and stick.*—The box has a lid held in place by the cord which passes through holes down both sides and across the bottom, ending above in a knot at the back of the stick. The stick is thrust in the girdle when traveling. Box and stick carved in native designs. Ainos of Yezo, 1888. 150694

*Moustache sticks.*—Carved flat sticks of wood, plain or lacquered, used to raise the moustache when drinking saké, and for throwing drops of saké as libations to the gods. The lacquered sticks are undoubtedly old. They are covered with Aino designs, but the lacquering is probably Japanese work. Length, about 13 inches. (See Fig. 77.) Ainos of Shari, Yezo, 1888. 150695–150699

*Parts of an Aino loom.*—The essential parts of a loom used for weaving ohiyo-bark cloth. Ainos of Yezo, 1888. 150700

*Shell for lamp.*—A shell of the *Pecten* used to hold oil and a small wick, to serve as a lamp. The shell is supported on the end of a three-forked stick set up in the fire-place. The wick is the pith of a plant, sometimes a bit of twisted bark fiber. Ainos of Yezo, 1888. 150701

*Tobacco box and stick.*—Similar to 150694, but much larger. Probably quite an old box. Wires for cleaning the pipe attached to the cord. (See Fig. 79). Ainos of Yezo, 1888. 150702

*Tobacco box and stick.*—Similar to 150694. Ainos of Yeterof, 1888. 150703

*Red lacquer cup.*—Used for saké. Made by the Japanese. Ainos of Yezo, 1888. 150704

*Large knife and case.*—The knife was obtained from the Japanese. The wooden case is of native workmanship, made in two pieces, bound together with bark, the outside elaborately carved. (See Fig. 76.) Ainos of Yeterof, 1888. 150705

*Bead necklace and copper ornament.*—Worn by women. The beads are of glass, blue and white, strung on a cord. The thin copper plate bears a stamped or hammered figure of a person seated on some mythic animal, with leaves of palms about. The beads are of Japanese manufacture, the plate of unknown origin. Ainos of Yezo, 1888. 150706

> The women are unwilling to part with their beads, which they seem to value either as heirlooms or as sacred treasures. Six dollars was once refused for a string smaller than this, although the people are extremely poor. All such ornaments have been obtained by trade with the Japanese, and many of them seem to be quite old. (A similar necklace shown in Pl. xc.)

*Earrings.*—Made of silver, with blue glass beads. Worn by the women. Specimens are of medium size, 3¼ inches in diameter, of Japanese manufacture. (Similar earrings shown in Plates XCIII and CIV.) Ainos of Yezo, 1888. 150707

*Earrings.*—Made of white metal. Worn by women; 2¼ inches in diameter. Ainos of Yezo, 1888. 150708

*Wooden plate.*—A round plate with carved pattern inside. Diameter, 7 inches. Ainos of Yeterof, 1888. 150708

*Wooden plate.*—A round plate with carved pattern inside. Diameter, 7 inches. (See Fig 74.) Ainos of Yeterof, 1888. 150709

*Wooden plate.*—A square plate with rounded corners; inside carved; 12 inches square. Ainos of Yeterof, 1888. 150710

*Wooden plates.*—Two square plates, with insides carved. Respectively 9¼ and 8 inches square. (See Fig. 74.) Ainos of Piratori, Yezo, 1888. 150711

*Winders for thread.*—Flat pieces of carved wood of various shapes, used for winding thread. Ainos of Yezo, 1888. 150712

*Teacup holders.*—Patterned after similar articles used by the Japanese. Made of wood, carved. Ainos of Yezo, 1888. 150713

*Cloth neck band and ornament.*—A simple band of blue-black Japanese cotton three-quarters of an inch wide, with button and button-hole to secure it around the neck. In front a nearly square flap hangs down about 1¼ inches, on which a small silver ornament is displayed. Worn mostly by children. Ainos of Yezo, 1888. 150714

*Tattooing knives.*—Ordinary Japanese knives with blades 3 to 3¼ inches in length in plain wooden handles. One of the blades bent near the end. Ainos of Yezo, 1888. 150715

*Kaba bark.*—Birch bark used to make the soot used in tattooing. The bark is burned and the soot condensed on a dish held over the flame. The soot is rubbed into the cuts on the face and arms, giving them a permanent somewhat bluish color. Ainos of Yezo, 1888. 150716

*Wooden dish.*—Oblong, with rounded ends. Length, 6 inches; width, 3¼ inches. Ainos of Yezo, 1888. 150717

*Chopsticks.*—Made by the Ainos, who doubtless learned to use them from the Japanese. Ainos of Yezo, 1888. 150718

*Needle.*—Used for making fish nets. Made of wood (See Fig.85.) Ainos of Yezo, 1888. 150719

*Mokuri.*—A musical instrument played like a jew's-harp, except that the reed is made to vibrate by jerking the string with the right hand while the instrument is held in front of the mouth, not against the teeth, between the thumb and finger of the left hand, the cord pressing around the little finger. (See Fig. 80.) Ainos of Yezo, 1888. 150720

*Bark dishes.*—Made of birch bark, the edges bound with bark fiber over strips of wood. Ainos of Yezo, 1888. 150721

*Wooden spoons.*—Various shapes and sizes, with long handles often curiously shaped to represent small branches sharply bent at the joints. Used for cooking and for eating. (See Fig. 75.) Ainos of Yezo, 1888. 150722

*Wooden flat spoons.*—Shaped like small spatulas; upper surfaces carved. Used for eating. Length, about 7 inches. (See Fig. 75.) Ainos of Piratori, Yezo. 1888. 150724

*Fish skins.*—Two pieces, used for making shoes. Ainos of Yezo, 1888. 150725

*Wooden spoons.*—Shaped like spatulas, carved on the upper surface. Like 150723, but smaller. Used by women. Length, 6 inches. Ainos of Piratori, Yezo, 1888. 150726

*Large wooden spatula.*—Used as a spoon or ladle to dish out food. Length, 17 inches; width of blade, 3 inches. Ainos of Piratori, Yezo, 1888. 150727

*Wooden pipe.*—A short pipe with stem carved. Length, 9 inches. Ainos of Yezo, 1888. (See Fig. 78.) 150728

*Knife and case.*—The blade of Japanese manufacture. The carved case made by the Ainos. (See Fig. 76.) Ainos of Yezo, 1888. 150729

*Two knife cases.*—Well carved in peculiar designs. Ainos of Yezo, 1888. (See Fig. 76.) 150731

*Wooden mallet.*—Formed of a branch and a portion of the main stem, which together make a naturally shaped hammer. Ainos of Yezo, 1888. 150732

*Wooden pipes.*—Usual form. Ainos of Yezo, 1888. (See Fig. 78) 150733, 150734

*Bead necklace.*—Made of colored glass beads and five larger hollow metal beads in the middle. Made by Japanese. Ainos of Yezo, 1888. 150736

*Small loom.*—Used for weaving the narrow belts of ohiyo bark. Ainos of Yezo, 1888. 150737

*Bark for mats.*—Elm bark, ohiyo, colored brown and black for weaving the square patterns of mats, bags, etc. Ainos of Yezo, 1888. 150738

*Shikeribikina.*—Leaves of a plant dried and preserved for food. Botanical name unknown. Used in stews. Ainos of Yezo, 1888. 150739

*Salmon roe.*—Dried fish roe, as preserved for winter food. Ainos of Yezo, 1888. 150740

*Dried cakes of lily root.*—Two cakes about 9½ inches in diameter by ¾ of an inch thick with a hole through the middle, tied together with strips of bark. The lily is probably the *uba-yuri* of the Japanese. Such cakes of various sizes are to be seen hanging in every house throughout Yezo, becoming thoroughly dried and seasoned by the smoke and hardened. (See also 150789.) Ainos of Yezo, 1888. 150741

*Cakes of lily root.*—Similar to 150741, but smaller. Ainos of Yezo, 1888. 150742

*String of lily root.*—Dried bulbs of the lily on strings. A very common article of food to be seen suspended in the houses throughout Yezo. Ainos of Yezo, 1888. 150744

*Nuts.*—The fruits of *Trapa bicornis*. Used for food. Ainos of Shari, Yezo, 1888. 150743

*String of fruits.*—Not identified, bulbels of inflorescence from some monocotyledonous plant. Used for food. Ainos of Abashiri, Yezo, 1888. 150746

*Flour.*—Prepared from some starch-bearing root. Ainos of Abashiri, Yezo, 1888. 150745

*Dried herrings.*—The fish are roughly cleaned and suspended from the beams of the houses until dried and smoked. Used for winter food. Ainos of Shari, Yezo, 1888. 150748

*Slices of pumpkin, dried.*—Not a common food among the Ainos. The pumpkin is now cultivated in the valley of Saru. Ainos of Piratori, Yezo, 1888. 150749

*Pukusa.*—A kind of food; apparently the stalks of a plant, cut in small pieces. Ainos of Piratori, Yezo, 1888. 150751

*Pukusakina.*—The leaves and stems of a plant belonging to the Ranunculaceae. Used for food. Ainos of Piratori, Yezo, 1888. 150752

*Beans.*—Not common in Yezo. Varieties grown in the Saru Valley. Ainos of Piratori, Yezo, 1888. 150753

*Strips of bark.*—Used for making the colored parts of mats. Probably from the *Tilia cordata*. (See No. 150632.) Ainos of Yezo, 1888. 150754

*Stalks of the rush.*—Stalks of *Scirpus maritimus;* used for weaving mats. (See No. 150632.) Ainos of Yezo, 1888. 150756

*Carrying band with stick.*—The band passes over the forehead in the same manner as 150679, but the load is supported on a stick about 15 inches in length which is held horizontally across the back. Ainos of Yezo, 1888. 150757

*Arrow with bone head.*—This form not very much used, bamboo heads being most common. Ainos of Yezo, 1888. 150758

*Arrow and small holder.*—The arrow of the usual form with bamboo head, poisoned for shooting bears. The holder made of leaves of scrub bamboo bound together with bark. Ainos of Yezo, 1888. 150759

*Stone arrowheads.*—From various parts of Yezo, found in the ground near the surface. Made of obsidian and chert. From three-quarters of an inch to over 2 inches in length. Probably made by the Ainos and used by them within the historic period. Ainos of Yezo, 1888. 150760

*Arrow poison.*—Prepared from the root of the aconite plant. Used to kill bears. The poison acts very quickly, and a wounded animal drops dead a few yards from where he is struck. Ainos of Yezo, 1888. 150761, 150762

*Rat trap.*—A kind of bow-trap in which the animal is caught between the arrow head and the frame of the trap. Ainos of Piratori, Yezo, 1888. 150764

*Hooked stick.*—Used to hold the stew-pot over the fire. The stick is suspended from the beams overhead by means of a slender rod or a bark rope. Ainos of Yezo, 1888. 150767

*Baby carrier.*—The band is placed around the breast instead of on the forehead, as with the Ainos. The child is carried in the sling on the back. Kurile Island natives on the Island of Shikotan, Japan, 1888. 150768

*Aconite plant.*—The leaves and flowers of the *Aconitum Japonicum* Thunb'g, from the roots of which the Ainos make the arrow poison. Island of Yezo, 1888. 150769

The following articles are the gift of the Sapporo Agricultural College:

*Dried fish.*—Salmon dried and salted. Tsuishikari Ainos, Yezo, 1888. 150770

*Wooden spoon.*—Rudely carved handle. Tsuishikari Ainos, Yezo, 1888. 150773

*Wooden dish with handle.*—This form not observed among the Yezo Ainos. Length, including handle, 15 inches; width, 9 inches. (See Fig. 69.) Tsuishikari Ainos, Yezo, 1888. 150774

*Bark fish tray.*—A large flat tray of bark, with the sides turned up slightly, strengthened with bamboo strips and bound with bark filaments. Length, 18 inches; width, 12 inches. Tsuishikari Ainos, Yezo, 1888. 150775

*Oblong deep dish.*—Dug out of a piece of wood, with a flat projection at one end for a handle. Used as a rice bowl. Length, 12 inches. Tsuishikari Ainos, Yezo, 1888. 150776

*Wooden dish.*—Wooden dish of peculiar shape; one end deeply excavated, the other end more shallow, resting on two legs. (See Fig. 69.) Tsuishikari Ainos, Yezo, 1888. 150777

*Japanese short sword.*—An old sword, regarded as a precious treasure by the people; doubtless a family heirloom. Tsuishikari Ainos, Yezo, 1888. 150778

*Man's coat.*—Made of the ohiyo or elm-bark cloth; embroidered with cotton yarn on a blue-black cotton ground. Tsuishikari Ainos, Yezo, 1888. 150779

*Woman's coat.*—Made of the ohiyo or elm-bark cloth; precisely like a man's coat but embroidered directly on the bark cloth with blue, red, and yellow cotton yarn. Tsuishikari Ainos, Yezo, 1888. 150780

*Belt.*—Made of ohiyo; rather wider than the belts of the Yezo Ainos. Length 36 inches; width 2 inches. Tsuishikari Ainos, Yezo, 1888. 150781

*Apron.*—Made of ohiyo, with cotton embroidery. Tsuishikari Ainos, Yezo, 1888. 150782

*Leggins.*—Made of ohiyo cloth, embroidered with cotton. Tsuishikari Ainos, Yezo, 1888. 150783

*Bow.*—A plain bow of the form common throughout Yezo. Tsuishikari Ainos, Yezo, 1888. 150784

*Quiver and arrows.*—Quiver made of wood bound with bark, having carved projected pieces along the sides. The form is common to all the Ainos. Arrows with bone or bamboo heads (see Fig. 84). Tsuishikari Ainos, Yezo, 1888. 150785, 150786

*Loom.*—Four pieces, constituting the essential parts of a native loom for weaving ohiyo-bark cloth. Tsuishikari Ainos, Yezo, 1888. 150787

*Harpoon.*—A barbed iron head, with lateral barbs on the shank, loosely fitted on the end of a wooden shaft and secured by thongs to a line. When a fish is struck the head leaves the shaft and the fish is pulled in with the line. Used for shallow-river fishing. Tsuishikari Ainos, Yezo, 1888. 150788

*Fish spear.*—A spear identical with 150662, but smaller. Tsuishikari Ainos, 1888. 150788

*Cake of dried lily root.*—Similar to Nos. 150741, 150742, and 150744, but of slightly different form. Tsuishikari Ainos, Yezo, 1888. 150789

*Wooden plates.*—Square and rectangular, carved on the inside. Ainos of Yezo, 1875 Collected by Gen. H. Capron. 19416

*Wooden plate.*—Ainos of Yezo, 1876. Collected by Benj. Smith Lyman. 22256

## LIST OF YEZO, AINO AND SHIKOTAN PHOTOGRAPHS OBTAINED BY ROMYN HITCHCOCK.

*Backs of houses, Shikotan.*—Showing the mounds of earth over the pits, connected with the main or thatched houses. Negative by R. Hitchcock, August, 1888. 56

*Villagers, Shikotan.*—The Kurile Islanders now occupying the dwellings on Shikotan. Negative by R. Hitchcook, August, 1888. 57

*View of Nemuro, Yezo.*—Looking over the the town toward the harbor, showing Bentenjima, on which are numerous pits and a shell-heap. Negative by R. Hitchcock, August, 1888. 58

*Pottery.*—Specimens of so-called "Aino" pottery, from the collection of M. l'Abbé Furet, Hakodate. Negative by R. Hitchcock, August, 1888. 59

*View of Hakodate.*—From back of the town, overlooking the harbor. Negative by R. Hitchcock, August, 1888. 61

*House on Shikotan.*—The front or thatched house and back passage of the Kurile Islanders. Negative by R. Hitchcock, August, 1888. 65

*Earth houses on Shikotan.*—Two detached earth or pit dwellings. Negative by R. Hitchcock, August, 1888. 66

*Aino house, Bekkai, Yezo.*—From the southeast. Showing a small, conical tent covered with mats on the south side of the house, in which an aged woman and a dog were found sleeping. (See page 451.) Negative by R. Hitchcock. August, 1888. 740

*Aino house and storehouse, Bekkai, Yezo.*—Another view of the house shown in No. 740, from the northeast, showing a storehouse in the foreground and a second house on the left. Negative by R. Hitchcock, August, 1888. 741

*Group of five Ainos, Shari, Yezo.*—Four women and one man standing at the entrance to a house, a Japanese on the right. Negative by R. Hitchcock, August, 1888. 742

*Aino man and woman, Shari, Yezo.*—Standing before the side door of a house. Negative by R. Hitchcock, August, 1888. 743

*Aino house and storehouse, Shari, Yezo.*—A large and well-built dwelling thatched with reeds (arundinaria). Fish nets drying on a frame raised on poles. Negative by R. Hitchcock, August, 1888. 744

*Aino house, Shari, Yezo.*—The house has a small aperture just beneath the ridge for the escape of smoke, and a hole in the roof, closed with a sliding shutter; also a lateral projection forming a side room for storage. There is a sliding front door, outside of which a mat may be dropped down in cold weather. Negative by R. Hitchcock, August, 1888. 745

*Aino house and storehouse, Shari, Yezo.*—This house has a thatched chimney in front of the smoke-hole under the ridge, but no opening in the roof. The smoke-hole is larger in houses of this kind than in those like 745. The entrance is through a passage way in front of the door, which affords protection from cold winds. Negative by R. Hitchcock, August, 1888. 746

*Two Aino men, Abashiri, Yezo.*—Showing the characteristic strong growth of hair on the legs. Negative by R. Hitchcock, August, 1888. 749

*Aino house, Tokoro, Yezo.*—Showing the method of construction. Negative by R. Hitchcock, August, 1888. 750

*Two Aino girls, Tokoro, Yezo.*—Showing the ordinary dress and the rough sandals. Negative by R. Hitchcock, August, 1888. 751

*Aged Aino man, Tokoro, Yezo.*—Leaning on his staff at the door of his hut. Negative by R. Hitchcock, August, 1888. 752

*Aged Aino woman, Tokoro, Yezo.*—The wife of the man shown in 752. Showing the tattoo marks on lips and arm. Negative by R. Hitchcock, August, 1888. 753

*Aged Aino man, Tokoro, Yezo.*—Nude figure, showing growth of hair on body and limbs: The hair about the breast and shoulders is very long, but the color is not dark enough to show distinctly in the photograph. Negative by R. Hitchcock, August, 1888. 754

*Aged Aino man, Tokoro, Yezo.*—Back view of the man shown in 754. Negative by R. Hitchcock, August, 1888. 755

*Aino canoes, Tokoro, Yezo.*—Boats used in river fishing, rudely dug out of a single log. The form varies in different parts of the island. Negative by R. Hitchcock, August, 1888. 756

*Two Aino women, Abashiri, Yezo.*—One holding a child. Good faces, long unkempt hair. Negative by R. Hitchcock, August, 1888. 757

*Two Aino men, Abashiri, Yezo.*—Good types of Yezo Ainos in ordinary dress. Negative by R. Hitchcock, August, 1888. 758

*Two Aino men, Abashiri, Yezo.*—One an old, patriarchal Aino, such as may often be found in Yezo. Dressed in good clothes, he would appear a dignified and wise old gentleman. The hairiness of the lower limbs well shown. Negative by R. Hitchcock, August, 1888. 759

*Two Aino women, Abashiri, Yezo.*—Excellent types. They are both tattooed, but the blue marking does not show distinctly in photographs. Negative by R. Hitchcock, August, 1888. 760

*Aino man, Abashiri, Yezo.*—A large and powerful man, chief of the Aino village. A sleeping dog on the ground. Negative by R. Hitchcock, August, 1888. 761

*Main street, Abashiri, Yezo.*—A Japanese town on the northeast coast. The low houses, with roofs weighted down with stones, being characteristic of the whole island. Negative by R. Hitchcock, August, 1888. 763

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# HANDBOOK FOR THE DEPARTMENT OF GEOLOGY IN THE U. S. NATIONAL MUSEUM.

## PART I.—GEOGNOSY.—THE MATERIALS OF THE EARTH'S CRUST.

By GEORGE P. MERRILL, *Curator.*

### INTRODUCTORY.

The history of the Geological Department of the National Museum may be said to date from the appointment of Dr. George W. Hawes as curator in 1880, after the completion of the new building. Prior to this time, owing to the limited amount of space that could be devoted to the department in the Smithsonian building, the collections were necessarily small. They were also of a very miscellaneous character, the principal material of real value from a lithologic or geologic standpoint which they were found to contain being a collection of 300 specimens of rocks from France, purchased in 1869 from Louis Saeman in Paris, and a similar collection of 148 specimens of rocks of Saxony, received in 1863 from the Royal Mining School of Freiberg, Saxony. There was, it is true, much material that might have been of value had there been any accurate data concerning it; but owing to the necessarily limited time and space that had been devoted to the care of these collections, in many cases nothing could be learned in regard to them, or if anything, the information was so meager as to be practically valueless. This was especially true of much of the material received from the various United States geological surveys and exploring expeditions.

At the time Dr. Hawes entered upon his duties as curator he also assumed charge of that branch of the Tenth Census relating to the quarrying industry of the United States. To this work he gave almost his entire attention, and the present building and ornamental stone collection is largely the result of his exertions in this direction. Dr. Hawes' connection with the Museum was, however, too short to allow the department to become fully organized, and at the time of his death matters were still in a state of great confusion owing to the large amount of material that had accumulated and the extent of the work undertaken, but necessarily uncompleted. The extensive collections received from Philadelphia at the close of the Centennial Exhibition in 1876 were still unpacked and unassorted, as were also those received from the various United States geological surveys that existed prior to the present organization.

To the Centennial Exhibition of 1876, the Tenth census (1880), the United States Land Office and the various United States geological surveys and exploring expeditions the department is largely indebted for whatever material it possessed prior to 1882. The time since the death of Dr. Hawes and the organization of the three departments of mineralogy, metallurgy, and lithology and physical geology from the one department of geology and mineralogy as it then existed, and the very recent reconsolidation of the department of metallurgy with that of lithology and physical geology, has been too short for more than a beginning to be made.

The handbook herewith presented is designed to be one of a systematic series, dealing as will be observed with but the first of the four divisions into which the science of geology is ordinarily divided.*

As at present arranged the collections of this division are installed in what it is hoped may ultimately prove to be temporary cases. Entering the hall from the east end, from the department of mammals, the visitor finds the first case of the series, that containing the elements and rock forming minerals, immediately upon his or her left. In this and all cases following the exhibits are so arranged that the observer, beginning with the extreme upper left corner, proceeds from left to right as in reading a book, each half case representing a page and each row of specimens a line of printed matter. The drawers in the lower portion of the cases are utilized for storage of material designed for study rather than exhibition. A list of the more important collections contained in these storage or table cases, as they are called, is given towards the close of this paper. (See pp. 589-591.)

In preparing the exhibit the idea advanced by Dr. G. B. Goode to the effect that a museum should consist of a series of labels illustrated by specimens has been ever kept in mind. Otherwise expressed the Curator has striven to make the department but a profusely illustrated text book in which the objects themselves serve as illustrations, and the text, reduced to a minimum amount, is furnished by the labels.

In arranging the exhibits under their various heads I have followed substantially the plan as laid down in Professor Geikie's text book,† and to which frequent references will be made. A copy of this work is to be found upon the table in the exhibition hall. In the present paper, relating only to geognosy, the purely descriptive matter has been given in considerable detail since the arrangement adopted did not sufficiently correspond with that of any available publication to make references in all cases advisable. In the three sections to follow it is not anticipated so large a proportion of text will be necessary, since it is proposed to follow more closely the arrangement adopted in the usual text books, and since moreover the objects themselves are more striking in appearance and their individual characteristics more readily apparent.

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*Two handbooks relating to the economic exhibits of the department have already appeared. The first, entitled The Collection of Building and Ornamental Stones in the United States National Museum, a handbook and catalogue, was prepared by the present writer and was issued in Part II of the Smithsonian Report for 1885-'86. The second, entitled Preliminary Descriptive Catalogue of the Systematic Collections in Economic Geology and Metallurgy, was prepared by Mr. F. P. Dewey, formerly curator of metallurgy, and will be published as a Bulletin. A "Preliminary Handbook of the Department Geology," in the form of a pamphlet of some fifty pages has also been prepared by the present writer and was issued as an appendix to the Museum report for 1888-89.

†Text Book of Geology. By A. Geikie, 2d ed., MacMillan & Co., London, 1885.

## GEOLOGY.

Geology is the science which treats of the earth's crust and its system of development. Physical geology is that branch of the science which treats of those geological phenomena which are attributable to physical agencies, the term physical being here introduced to distinguish the department from that of paleontological geology, which treats of the plants and animals which existed in past ages of the globe, but which now occur only as fossils or petrefactions.

The science of physical geology has been conveniently divided into four heads: (1) Geognosy, which treats of the earth's substance, the crust, and its composition; (2) dynamical geology, which treats of the agencies by which changes have been brought about in the composition and structure of the earth's crust; (3) geotectonic or structural geology, which treats of the structure of this crust, its original condition, and the structural changes which it has since undergone; and (4) historical or stratigraphic geology, which treats of the order of succession of the rocks without regard to their composition or methods of formation.

### I.—GEOGNOSY.—THE MATERIALS OF THE EARTH'S CRUST.

The earth's crust is composed of mineral matter in various conditions and stages of consolidation, all of which, whether loose like sand or compact like granite, are included under the general name of rock. In the accompanying collections it has been found most convenient to treat this subject under four distinct heads: (1) The chemical elements constituting rocks. (2) The minerals constituting rocks. (3) The physical properties of rocks, as structure, color, and fracture, and (4) The kinds of rocks.

#### (1) THE CHEMICAL ELEMENTS CONSTITUTING ROCKS.

Although there are sixty-four elements known, but sixteen occur in any great abundance or form more than an extremely small proportion of the earth's crust. These sixteen, arranged according to their chemical properties and the order of their abundance, are as follows:

| METALLOIDS | METALS. |
|---|---|
| Oxygen. | Aluminum. |
| Silicon. | Calcium. |
| Carbon. | Magnesium. |
| Sulphur. | Potassium. |
| Hydrogen. | Sodium. |
| Chlorine. | Iron. |
| Phosphorus. | Manganese. |
| Fluorine. | Barium. |

Below is given a transcript of the labels used in this series.

*Oxygen.* Symbol O; atomic weight 16: This substance is a colorless, invisible gas possessing neither taste or smell. It exists in the free state in the atmosphere, of which it constitutes about one fifth by bulk, whilst in combination with other elements it forms nearly half the weight of the solid earth and eight-ninths by weight of water. It enters into combination with all the other elements, fluorine excepted, forming what are known as oxides. Thus hematite and magnetite, two very common ores of iron, are formed by the combination in different proportions of oxygen and iron.

*Silicon.* Symbol Si; atomic weight 28: Next to oxygen this is the most abundant of the earth's constituents. It, however, never occurs in the free state, but combined with oxygen as silica it forms more than one-half of the matter of the earth's crust.

*Carbon.* Symbol C; atomic weight 12: This substance occurs in the free state as graphite and the diamond, but is much more common in the impure form of common coal. Uncombined with other elements, it never exists in either a liquid or gaseous form, but in combination with oxygen as carbonic acid or carbon dioxide ($CO_2$) it is almost universally present in the air, rain, sea and river waters. In this form also it constitutes about one-fifth by weight of common limestone. It is also an abundant constituent of many other minerals and rocks.

*Sulphur.* Symbol S; atomic weight 32: Sulphur occurs in nature in both the free and combined state. In the free state it is found in volcanic regions such as Sicily, Iceland, and the Western United States. Its usual form of occurrence is in combination with the metals to form sulphides, or with oxygen and a metal to form sulphates. Sulphur and iron combine to form iron pyrites or iron disulphide ($FeS_2$), while sulphur, oxygen, and calcium combine to form sulphate of calcium or gypsum ($CaSo_4$).

*Hydrogen.* Symbol H; atomic weight 1: Hydrogen is a colorless invisible gas, without taste or smell. It occurs free in small proportions in certain volcanic gases, but its most common form is in combination with oxygen to form water ($H_2O$), of which it forms 11.13 per cent. by weight. It also occurs in combination with carbon to form the hydrocarbons, such as the mineral oils (petroleum, etc.) and gases.

*Chlorine.* Symbol Cl; atomic weight 35.5: Chlorine occurs free in nature only in limited amounts and in volcanic vents. Its most common form is in combination with hydrogen, forming hydrochloric acid or with the metals to form chlorides. It combines with sodium to form sodium chloride or common salt ($NaCl$), which is the most important mineral ingredient in sea water and which can usually be detected in rain and ordinary terrestrial waters. In this form also it forms extensive beds of rock salt, which are mined for commercial purposes.

*Phosphorus.* Symbol P; atomic weight 31: Phosphorus never occurs in nature in a free state, but is found in great abundance in combination with oxygen or one of the metals. Combined with calcium and oxygen it forms calcium phosphate, which is found in the bones of animals, the seeds of plants, and also the minerals phosphorite and apatite.

*Fluorine.* Symbol F; atomic weight 19: Fluorine does not occur free in nature and can be isolated by artificial chemical methods only with great difficulty. It is the only element that does not combine with oxygen. It occurs chiefly combined with calcium to form fluorspar, but traces of it are found in sea water and in the bones, teeth, blood, and milk of mammals.

*Aluminum.* Symbol Al; atomic weight 27.4: Aluminum is next to oxygen and silicon, probably the most abundant element of the earth's crust, of which it is estimated to form about one-twelfth. It has never been found in nature in the free state, but commonly occurs in combination with silicon and oxygen, in which form it is an abundant constituent of feldspar, kaolin, clay-slate, and many other rocks and minerals. In combination with oxygen it forms the minerals corundum, ruby, and sapphire.

*Calcium.* Symbol Ca; atomic weight 40: Calcium is one of the commonest and most important elements of the earth's crust, of which it has been estimated to compose about one-sixteenth. It does not occur free in nature, but its most common form is in combination with carbon dioxide, forming the mineral calcite ($CaCO_3$), or the rock limestone. In this form it is slighty soluble in water containing carbonic acid, and hence has become an almost universal ingredient of all natural waters, whence it furnishes the lime necessary for the formation of shells and skeletons of the various tribes of mollusca and corals. In combination with sulphuric acid, calcium forms the rock gypsum.

*Magnesium.* Symbol Mg; atomic weight 24: Magnesium does not occur free in nature, but is most commonly found in combination with carbonic acid as carbonate of magnesia forming thus an essential part of the rock dolomite. The bitter taste of sea water and some mineral waters is due to the presence of salts of magnesia. In combination with silica it forms an essential part of such rocks as serpentine, soapstone and talc.

*Potassium.* Symbol K; atomic weight 39.1: Potassium does not occur free in nature, but combined with silica is an important element in many mineral silicates, as, for instance, orthoclase. Granitic rocks contain from 4 to 5 per cent. of potassium salts, which on their decomposition become available for plant foods. As a chloride, potassium is always found in sea water, and as a nitrate forms the valuable natural salt commonly called niter or saltpeter.

*Sodium.* Symbol Na; atomic weight 23: Sodium is never found free in nature, but its most common form is in combination with chlorine forming common salt, an important ingredient of sea water. Combined with silica sodium is an important element in many mineral silicates.

*Iron.* Symbol Fe; atomic weight 56: Iron is the most abundant of the heavy metals, and occurs in nature both free and combined with other elements. In the free state it is found only to a limited extent in basaltic rocks and meteorites, but in combination with oxygen it is one of the most widely diffused of metals, and forms the coloring matter of a large number of rocks and minerals. In this form, too, it forms the valuable ores of iron known as magnetite and hematite. In combination with sulphur it forms the mineral pyrite $FeS_2$.

*Manganese.* Symbol Mn; atomic weight 55: Next to iron, manganese is the most abundant of the heavy metals. It occurs in nature only in combination with oxygen, in which form it is associated in minute quantities with iron in igneous rocks or in the forms known mineralogically as pyrolusite, psilomelane and wad. As the peroxide of manganese it occurs in concretionary forms scattered abundantly over the floor of the deep sea.

*Barium.* Symbol Ba; atomic weight 137: Barium occurs in nature combined with sulphuric acid, forming the mineral barite, or heavy spar, or with carbonic acid forming the mineral witherite.

### (2) THE MINERALS OF ROCKS.

A rock is a mineral aggregate; more than this, it is an essential portion of the earth's crust, a geological body occupying a more or less well-defined position in the structure of the earth, either in the form of stratified beds, eruptive masses, sheets or dykes, or as veins and other chemical deposits of comparatively little importance as regards size and extent. Having considered the elements which in their various combinations go to make up the minerals, we will now consider the minerals which go to make up the rocks. The collection, it should be stated, is designed to show only those minerals commonly found in rock masses, or which make up any considerable portion of the mass of a rock of any kind. The specimens are selected, not on account of their beauty or fine crystallographic development, but ordinary forms, both crystalline and massive, are shown in their principal varieties.

The mineral composition of rocks, it may be stated, "is greatly simplified by the wide range of conditions under which the commonest minerals can be formed, thus allowing their presence in rocks of all classes and of whatever origin. Thus quartz, feldspar, mica, the minerals of the hornblende or pyroxene group can be formed in a mass cooling from a state of fusion; they may be crystallized from solution, or be formed from volatilized products. They are therefore the commonest of minerals and rarely excluded from rocks of any class, since there is no process of rock formation which determines their absence." Moreover, most of the common minerals, like the feldspars, micas, hornblendes, pyroxenes, and the alkaline carbonates possess the capacity of adapting themselves to a very considerable range of compositions. In the feldspars, for example, the alkalies, lime, soda, or potash may replace each other almost indefinitely, and it is now commonly assumed that true species do not exist, but all are but isomorphous admixtures passing into one another by all gradations, and the names albite, oligoclase, anorthite, etc., are to be used only as indicating convenient stopping and starting points in the series. Hornblende or pyroxene, further, may be pure silicates of lime and magnesia, or iron and manganese may partially replace these substances. Lime carbonate may be pure, or magnesia may replace the lime in any proportion. These illustrations are sufficient to indicate the reason of the great simplicity of rock masses as regards their chief constituents, and that whatever may be the composition of a mass within nature's limits, and whatever may be the conditions of its origin, the probabilities are that it will be formed essentially of one or more of a half a dozen minerals in some of their varieties.

But however great the adaptability of these few minerals may be they are, nevertheless, subject to very definite laws of chemical equivalence. There are elements which they can not take into their composition, and there are circumstances which retard their formation while other minerals may be crystallizing. In a mass of more or less accidental composition it may, therefore, be expected that other minerals will form, in it may be, considerable numbers, but minute quantities.* It is customary to speak of those minerals which form the chief ingredients of any rock, and which may be regarded as characteristic of any particular variety, as the essential constituents, while those which occur in but small quantities, and whose presence or absence does not fundamentally affect its character, are called *accessory* constituents. The accessory mineral which predominates, and which is, as a rule, present in such quantities as to be recognizable by the unaided eye, is the *characterizing* accessory. Thus a biotite granite is a stone composed of the essential minerals quartz and potash feldspar, but in which the accessory mineral biotite occurs in such quantities as to give a definite character to the rock. The minerals of rocks may also be conveniently divided into two groups, according as they are products of the first consolidation of the mass or of subsequent changes. This is the system here adopted. We thus have:

(1) The original or primary constituents, those which formed upon its first consolidation. All the essential constituents are original, but

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* Hawes, the Minerals of Building Stones, Rep. Tenth Census, vol. x, p. 4.

on the other hand all the original constituents are not essential. Thus, in granite, quartz and orthoclase are both original and essential, while beryl and zircon or apatite, though original, are not essential.

(2) The secondary constituents are those which result from changes in a rock subsequent to its first consolidation, changes which are due in great part to the chemical action of percolating water. Such are the calcite, chalcedony, quartz, and zeolite deposits which form in the druses and amygdaloidal cavities of traps and other rocks.

Below is given a list of the rock-forming minerals arranged as above indicated; only the more important of these are exhibited. Although these are sufficiently described as regards their chemical and crystallographic properties in any of the mineralogies, it has been found necessary to label them very fully in order to indicate their relations and their comparative importance in the rocks of which they form a part. It is not deemed essential that the matter of these labels be reproduced here, though the following is inserted as a sample:

## MAGNETITE. MAGNETIC IRON ORE.

*Composition:* $FeO+Fe_2O_3$=iron sesquioxide 68.97 per cent.; iron protoxide 31.03 per cent.

*Crystalline System:* Isometric.

Occurs as an original constituent in many schists and granites; in the latter usually in minute crystals visible only with the microscope. It is almost invariably present in many igneous rocks, such as diorite, diabase, and basalt, and frequently occurs in immense beds, forming a valuable iron ore.

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*Original minerals.*

1. Quartz.
2. The Feldspars.
   - 2*a*. Orthoclase.
   - 2*b*. Microcline.
   - 2*c*. Albite.
   - 2*d*. Oligoclase.
   - 2*e*. Andesite.
   - 2*f*. Labradorite.
   - 2*g*. Bytownite.
   - 2*h*. Anorthite.

*Original minerals*—Continued.

3. The Amphiboles.
   - 3*a*. Hornblende.
   - 3*b*. Tremolite.
   - 3*c*. Actinolite.
   - 3*d*. Arvedsonite.
   - 3*e*. Glaucophane.
   - 3*f*. Smaragdite.
4. The Monoclinic Pyroxenes.
   - 4*a*. Malacolite.
   - 4*b*. Diallage.

*Original minerals*—Continued.

4. The Monoclinic Pyroxenes—Cont'd.
    - 4*c*. Augite.
    - 4*d*. Acmite.
    - 4*e*. Aegerite.
5. The Rhombic Pyroxenes.
    - 5*a*. Enstatite (Bronzite).
    - 5*b*. Hypersthene.
6. The Micas.
    - 6*a*. Muscovite.
    - 6*b*. Biotite.
    - 6*c*. Phlogopite.
7. Calcite.
8. Dolomite.
9. Gypsum.
10. Olivine.
11. Beryl.
12. Tourmaline.
13. Garnet.
14. Vesuvianite.
15. Epidote.
16. Zoisite.
17. Allanite.
18. Andalusite.
19. Staurolite.
20. Fibrolite.
21. Cyanite.
22. Scapolite.
23. Apatite.
24. Elæolite and Nepheline.
25. Leucite.
26. Cancrinite.
27. The Sodalite Group.
    - 27*a*. Sodalite.
    - 27*b*. Hauyn (nosean).
28. Zircon.
29. Chondrodite.
30. Cordierite.
31. Topaz.
32. Corundum.
33. Titanite (sphene).
34. Rutile.
35. Menaccanite.
36. Magnetite.
37. Hematite.
38. Chromite.
39. The Spinels.
    - 39*a*. Pleonast.
    - 39*b*. Picotite.
40. Pyrolusite.
41. Halite (common salt).
42. Fluorite.
43. The Elements.
    - 43*a*. Graphite.
    - 43*b*. Carbon.

*Original minerals*—Continued.

43. The Elements—Continued.
    - 43*c*. Iron.
    - 43*d*. Copper.
44. The Metallic Sulphides.
    - 44*a*. Galena.
    - 44*b*. Sphalerite.
    - 44*c*. Pyrrhotite.
    - 44*d*. Marcasite.
    - 44*e*. Pyrite.
    - 44*f*. Chalcopyrite.
    - 44*g*. Arsenopyrite.

*Secondary minerals.*

1. Quartz.
    - 1*a*. Chalcedony.
    - 1*b*. Opal.
    - 1*c*. Tridymite.
2. Albite.
3. The Amphibole Group.
    - 3*a*. Hornblende.
    - 3*b*. Tremolite.
    - 3*c*. Actinolite.
    - 3*d*. Uralite.
4. Muscovite (Sericite).
5. The Chlorites.
    - 5*a*. Jefferisite.
    - 5*b*. Ripidolite.
    - 5*c*. Penninite.
    - 5*d*. Prochlorite.
6. Calcite (and aragonite).
7. Wollastonite.
8. Scapolite.
9. Garnet.
10. Epidote.
11. Zoisite.
12. Serpentine.
13. Talc.
14. Kaolin.
15. Pectolite.
16. Laumontite.
17. Prehnite.
18. Thomsonite.
19. Natrolite.
20. Analcite.
21. Datolite.
22. Chabazite.
23. Stilbite.
24. Heulandite.
25. Harmotome.
26. Magnetite.
27. Hematite.
28. Limonite.
29. Siderite.
30. Pyrite.
31. Pyrrhotite.

### (3) PHYSICAL AND CHEMICAL PROPERTIES OF ROCKS.

Under this head are here grouped several small series of rocks designed to show (1) the structure of rocks—the manner in which their various constituent parts are associated or grouped together to form rock masses; (2) the specific gravity of rocks; (3) the chemical composition; (4) the color, and (5) the fracture and manner of breaking.

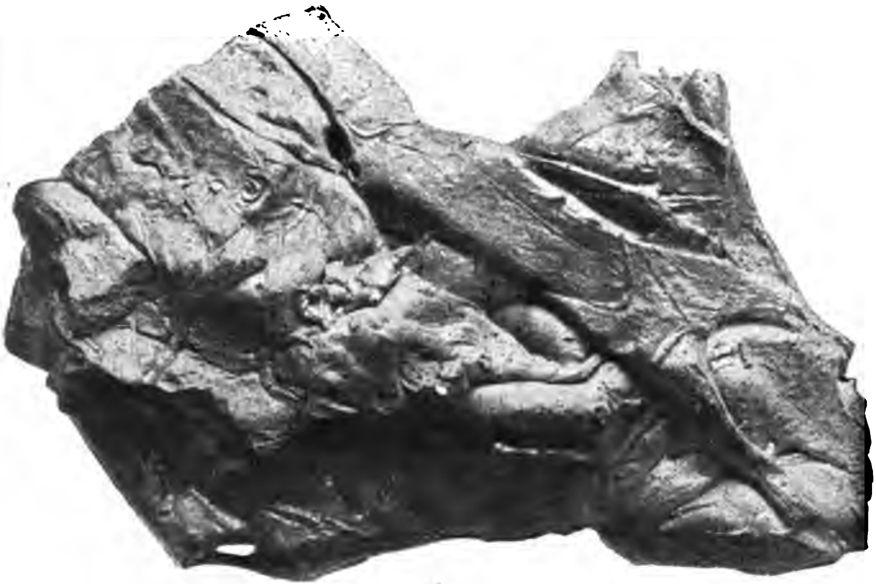
### I.—THE STRUCTURE OF ROCKS.

*A. Macroscopic structure.*—It is the object of this exhibit to show all the more typical forms of rock and structure. In other words, to illustrate by means of specimens the meanings of certain words and phrases in common use in geologic nomenclature, but whose exact significance or force is poorly comprehended by the public at large. In this collection the rocks are divided into four primary groups. That is, they represent four primary types of structure, each of which in its turn exhibits a more or less parallel series of secondary structures. These types of structure are (1) crystalline; (2) vitreous or glassy; (3) colloidal, and (4) clastic or fragmental. The first of these (1), of which granite and crystalline limestone are selected as types (Specimens Nos. 35966 and 26679), are composed wholly of crystals or crystalline granules without trace of cementing material or glassy matter. Rocks of the second group (2), of which obsidian is the type (Specimen 29631, from Mono Lake, California), are made up wholly or in great part of amorphous glass. This structure is confined to rocks of volcanic origin. Rocks of this class pass by insensible gradations through microlitic, felsitic, and micropegmatitic stages into holocrystalline forms. Rocks of the third class (3), the collodial, are completely amorphous, and have a jelly or glue-like structure. This structure is less common than the others, and is found only in rocks of chemical origin. It is illustrated by the siliceous sinter (Pealite, No. 28964) from the Yellowstone Park; Semi Opal from Louisiana (No. 38612); Flint nodule (No. 38012), from the chalk cliffs of England; and the green serpentine (No. 39038) from Montville, New Jersey.

Rocks of the fourth group (4), of which sandstone is selected as the type, are composed wholly of fragments of pre-existing rocks, the individual particles being held together by (1) cohesion, or (2) by a cement composed of silica, iron oxides, carbonate of lime or clayey matter. A coarse Triassic rock from Deerfield, Massachusetts (No. 26144), illustrates this type of structure.

The exhibit is arranged as follows:

| | |
|---|---|
| 1. Types of crystalline rocks: | |
| (I) Tourmaline granite, Minot, Maine. | 35966 |
| (II) Crystalline limestone, Danville, New Jersey. | 26679 |
| (1) Granular structure: | |
| Dolomite, Lee, Massachusetts. | 27014 |
| (2) Compact structure: | |
| (*a*) Lithographic limestone, St. Louis, Missouri. | 26719 |
| (*b*) Felsite, Marblehead Neck, Massachusetts. | 35965 |



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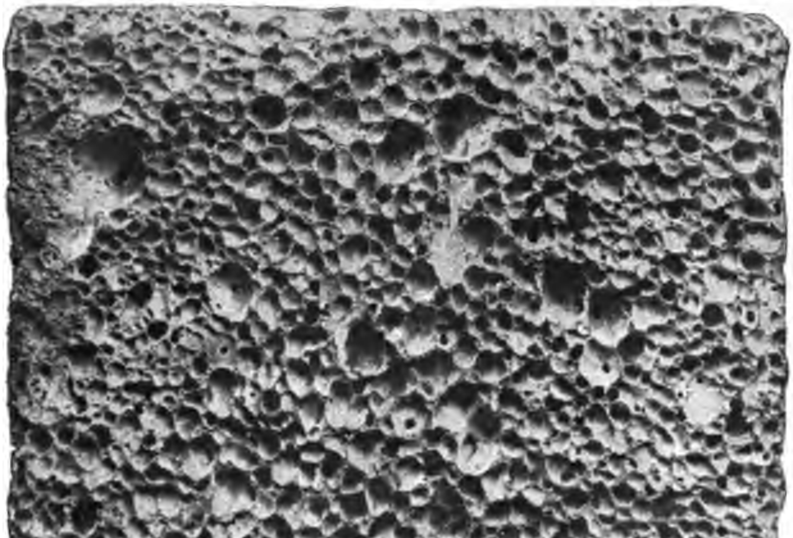

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FIG. 1. Basalt showing slaggy structure. (Cat. No. 35853, U. S. N. M.)
FIG. 2. Basalt showing vesicular structure. (Cat. No. 70592, U. S. N. M.)

| | |
|---|---|
| 1. Types of crystalline rocks—Continued. | |
| (3) Massive structure: | |
| Diabase, Goose Creek, Loudoun County, Virginia. | 28116 |
| (4) Stratified structure: | |
| (*a*) Limestone, East Conshohocken, Pennsylvania. | 26983 |
| (*b*) Sandstone, Summit County, Utah. | 70595 |
| (5) Foliated or schistose structure: | |
| Gneiss, Lawrence, Massachusetts. | 26547 |
| (6) Fluidal or fluxion structure: | |
| (*a*) Quartz porphyry, Milton, Massachusetts. | 35946 |
| (*b*) Rhyolite, High Rock Cañon, Nevada. | 35441 |
| (7) Porphyritic structure: | |
| (*a*) Porphyrite, Shasta County, California. | 70594 |
| (*b*) Quartz porphyry, Marblehead Neck, Massachusetts. | 35960 |
| (8) Vesicular structure: | |
| (*a*) Basalt, Ice Cave, Butte, Utah. | 70592 |
| (*b*) Andesite, Portugal. | 37926 |
| (9) Amygdaloidal structure: | |
| (*a*) Melaphyr, Brighton, Massachusetts. | 35940 |
| (*b*) Melaphyr, Oelnitz, Saxony. | 36133 |
| (10) Slaggy structure: | |
| Basaltic lava, Hawaiian Islands. | 35853 |
| (11) Concretionary structure: | |
| Kugeldiorite, Corsica. | 36054 |
| (12) Dendritic structure: | |
| Limestone, England. | 29113 |
| (13) Botryoidal structure: | |
| Hematite, Cleater Moor, Cumberland, England. | 36085 |
| (14) Fibrous structure: | |
| (*a*) Asbestus, Charlottsville, Virginia. | 28109 |
| (*b*) Gypsum, Nova Scotia. | 37624 |
| (15) Radiated structure: | |
| Wavellite, Garland County, Arkansas. | 36104 |
| (16) Columnar structure: | |
| Columnar calcite. | 36787 |
| (17) Brecciated structure: | |
| Felsite breccia, Marblehead Neck, Massachusetts. | 35952 |
| (18) Cavernous structure: | |
| Dolomite, Chicago, Illinois. | 27508 |
| 2. Types of vitreous rock: | |
| 1. Black Obsidian, Mono Lake, California. | 29631 |
| (1) Fluidal or fluxion structure: | |
| Obsidian, Glass Buttes, Oregon. | 35921 |
| (2) Vesicular structure: | |
| Obsidian Pumice, Mono Lake, California. | 29630 |
| (3) Porphyritic structure: | |
| Porphyritic Obsidian, Yellowstone National Park. | 28888 |
| (4) Perlitic structure: | |
| Perlite, Schemnitz, Hungary. | 36134 |
| (5) Spherulitic structure: | |
| Obsidian, Yellowstone National Park. | 18969 |
| (6) Capillary structure: | |
| Peles Hair, Volcano of Kilauea, Hawaiian Islands. | 8902 |

| | |
|---|---|
| 3. Types of colloidal rock: | |
| (I) Siliceous sinter, (Pealite), Yellowstone National Park. | 28964 |
| (II) Opal, Rapides Parish, Louisiana. | 38612 |
| (III) Flint, England. | 36012 |
| (IV) Serpentine, Montville, New Jersey. | 39038 |
| (1) Tufaceous structure: | |
| Calc tufa, Yellowstone National Park. | 72861 |
| (2) Botryoidal structure: | |
| Chalcedony after coral, Florida. | 39051 |
| (3) Concretionary structure: | |
| (*a*) Oölitic limestone, Cache Valley, Utah, | 35305 |
| (*b*) Pisolitic limestone, Pyramid Lake, Nevada. | 35306 |
| (*c*) Siliceous concretions, Yellowstone National Park. | 12[illegible] |
| (4) Cellular structure: | |
| Buhr stone, Sebastopol, Georgia. | 36051 |
| 4. Types of fragmental rock: | |
| I. Coarse sandstone, Deerfield, Massachusetts. | 26144 |
| (1) Granular structure: | |
| Sandstone, Berkshire, Massachusetts. | 72798 |
| (2) Compact structure: | |
| Sandstone, Hingham, Massachusetts. | 35939 |
| (3) Laminated structure: | |
| (*a*) Slate, Poultney, Vermont. | 27183 |
| (*b*) Sandstone, Fort Collins, Colorado. | 35998 |
| (4) Banded structure: | |
| Shale baked by trap dike, Deckertown, New Jersey. | 36767 |
| (5) Concretionary structure: | |
| Coquina, St. Augustine, Florida. | 28662 |
| (7) Conglomerated structure: | |
| Conglomerate, Beltsville, Maryland. | 25647 |
| (9) Brecciated structure: | |
| (*a*) Calcareous Breccia, Vituland, Italy. | 36109 |
| (*b*) Siliceous Breccia, Yellowstone National Park. | 37924 |

The following show the types of labels used in these series:

*Vitreous Rocks.*

VESICULAR STRUCTURE.

**Obsidian Pumice.**

MONO LAKE, California. 29,630.

Collected by G. K. GILBERT, 1883.

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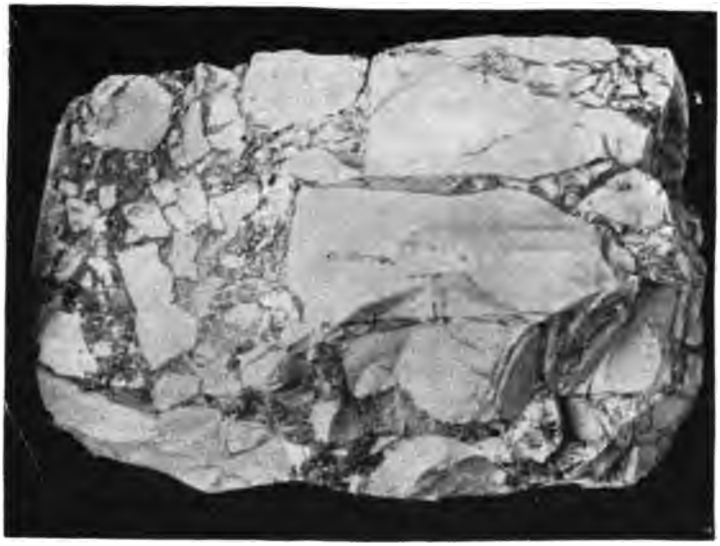
*B. Microscopic structure.*—Shown by twelve transparencies in the windows.

The circular transparencies in the windows are designed to show the microscopic structure and mineral composition of the more common types of rocks. In preparing the transparencies a small chip from each rock was ground so thin as to be transparent (from $\frac{1}{500}$ to $\frac{1}{600}$ of an inch), and then after being mounted between thin slips of glass was photographed through a microscope and between crossed nicol prisms. From the negatives thus prepared further enlargements were made by



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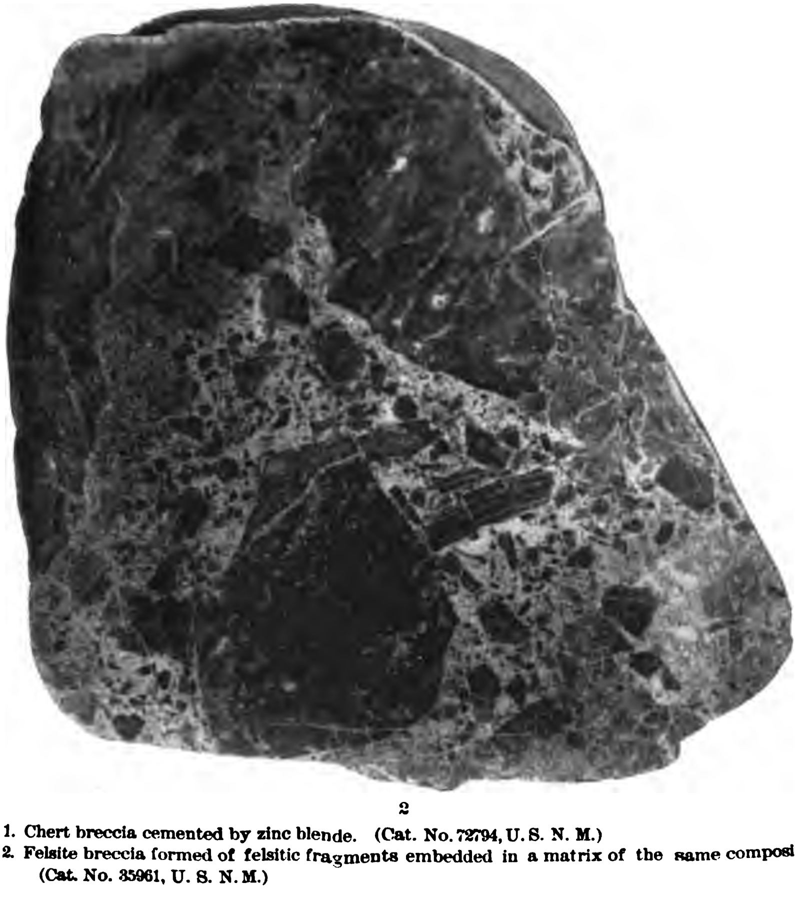

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FIG. 1. Chert breccia cemented by zinc blende. (Cat. No. 72794, U. S. N. M.)
FIG. 2. Felsite breccia formed of felsitic fragments embedded in a matrix of the same composition. (Cat. No. 35961, U. S. N. M.)

means of a solar camera, the final print being on glass and 1 foot in diameter; that is, that portion of the stone, which is in reality about one-fourth of an inch in diameter, is here made to appear 1 foot in diameter. These illustrations were then painted by hand, the artist taking his colors from an examination of the section itself under the microscope. The colors of the various minerals, it will be observed, are not always the true colors of the minerals themselves, but rather the color they assume when, after being cut at different angles with their optic and crystallographic axes, they are viewed by means of polarized light. Such colors are therefore somewhat misleading at first, but are rendered necessary for the purposes of identification and to bring out sharply the lines of separation between one mineral and another, and thus show the structure and composition of the rock. Owing to the thinness of the section (which is about $\frac{1}{100}$ of an inch) it would appear in ordinary light, *i. e.*, light not polarized, nearly colorless or with only dark flecks and faint tinges of color here and there.

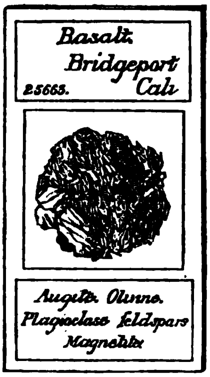

Fig. 89.

MOUNTED THIN SECTION OF ROCK AS PREPARED FOR THE MICROSCOPE.

This process of preparing thin transparent sections from rocks and studying them by means of a compound microscope is of comparatively modern origin, having come into general use only within the past dozen years. Although the practice of grinding down thin sections of fossils was followed to some extent by H. Witham as early as 1831, the importance of its application to minerals and rocks does not appear to have been fully realized until as late as 1858, when Dr. H. C. Sorby announced the results obtained by him in examining thin sections of simple minerals. Since this latter date the progress has been steady and rapid, and has given a fresh impetus to geological research.

The efficiency of the method is based upon the fact that every crystallized mineral has certain definite optical properties, *i. e.*, when cut in such way as to allow the light to pass through it, will act upon this light in a manner sufficiently characteristic to enable one working with an instrument combining the properties of a microscope and stauroscope to ascertain at least to what crystalline system it belongs, and in most cases by studying also the crystal outlines and lines of cleavage the mineral species as well. To enter upon a detailed description of the method by which this is done would be out of place here, since it involves the subject of polarization of light and other subjects which must be studied elsewhere. The reader is referred to any authoritative work on the subject of light, and to Mr. J. P. Idding's translation of Professor Rosenbusch's work on optical mineralogy.*

This method is of value, not merely as an aid in determining the mineralogical composition of a rock, but also, and what is often of more importance, its structure and the various changes which have taken place in it since its first consolidation. Rocks are not the definite and unchangeable mineral compounds they were once considered, but are rather ever varying aggregates of minerals, which even in themselves undergo structural and chemical changes almost without number. It is a common matter to find rock masses which may have had originally the mineral composition and structure of diabase, but which now are mere aggregates of secondary products such as chlorite, epidote, iron oxides, and kaolin, with perhaps scarcely a trace of the unaltered original constituents, yet the rock mass retains its geological identity, and to the naked eye shows little, if any, sign of the changes that have gone on. These and other changes are in part chemical and in part structural or molecular. A very common mineral transformation in basic rocks is that from augite to hornblende. This takes place merely through a molecular readjustment of the particles whereby the augite with its gray or brown colors and rectangular cleavages passes by uralitic stages over into a green hornblende, a mineral of the same chemical composition, but of different chrystallographic form. This transformation in its incompleted state is shown in the accompanying figure, in which the central nearly colorless portion with rectangular cleavage represents the original augite, while the outer dotted portion with cleavage lines cutting at sharp and obtuse angles, is the hornblende. This change is due to slow and gradual pressure exerted through unknown periods of time upon the rock masses, and the final result is the production of a rock of entirely different type and structure from that which originally cooled from the molten magma. The change such as above described is well shown in the two specimens of gabbro and gabbro-diorite from near Mount Hope, in Baltimore, Nos. 36754 and 36755. These are both portions of the same rock mass, but one is a plagioclase hypersthene rock, while the other is a plagioclase hornblende rock; in other words, one is a gabbro while the other is now a diorite, although both are chemically identical and were once mineralogically and structurally identical as well. Another and very common change shown by this method is that from olivine, pyroxene, or other magnesian silicate minerals to serpentine. This change will be dwelt upon more fully in the collection showing the origin of serpentinous rocks.

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* Microscopic Physiography of Rock-making minerals, Wiley & Son, New York.

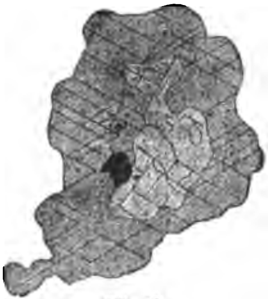


Fig. 90.

AUGITE ALTERING INTO HORNBLENDE.

(After Hawes.)

This science of microscopic petrography, as it is technically called, has also been productive of equally important results in other lines. As an instance of this may be mentioned the discovery that the structural features of a rock are dependent not upon its chemical composition or geological age, but upon the conditions under which it cooled from a molten magma, portions of the same rock varying all the way from holocrystalline granular through porphyritic to glassy forms. To this fact allusion has already been made.

The thin sections from which these transparencies were prepared are shown in the case. The actual portions of the rock shown in each transparency is that surrounded by the dark ring in the section.

The transparencies are as follows:

(1) Crystalline Limestone, or marble, from West Rutland, Vermont. Transparency No. 39074.

The transparency shows the stone to be made up wholly of calcite crystals. Observe that, owing to their crowded condition, none of the crystals have perfect crystallographic outlines, but have mutually interfered with one another's growth, giving rise to rounded and angular granules only. The striations, cutting at various angles across the granules, are cleavage lines and twin lammellæ. (See also Fig. 93, p. 545.)

(2) Granite, Sullivan, Maine. Transparency No. 39075. Composition, quartz, feldspars, and mica.

The clear colorless and the brilliant blue portions are quartz; the clouded portions sometimes bounded by longitudinal parallel striations are the feldspars, while the faintly yellowish almost opaque forms in small shreds near the center are black mica.

Observe that in this case as in that of the limestone the rock is fully crystalline, but that none of the minerals possess perfect crystalline outlines, owing to a mutual interference during the process of their formation. Such a structure is called crystalline granular, or more technically hypidiomorphic. It is a structure characteristic of plutonic or deep-seated rocks. (See Fig. 1, Pl. CXX.)

(3) Diabase, Weehawken, New Jersey. Transparency No. 39076.

This rock is composed mainly of the mineral augite and a triclinic variety of feldspar. The clear, colorless elongated forms often showing a parallel banding are the feldspars, and the large irregular forms of a bronze yellow and green color are augite.

Observe here that while the rock, as in the case of the granite, is wholly crystalline, the various minerals have interfered less in process of growth, giving in part very perfect crystalline forms. Such a structure is technically called panidiomorphic. (See also Fig. 96, p. 562.)

(4) Serpentine, Chester, Pennsylvania. Transparency No. 39077.

Serpentine is not known in crystals, but occurs as an amorphous product of alteration after other minerals. The section shows the characteristic reticulated structure. The interspaces in this case were filled with calcite and frequent grains of chrome iron. (See also Fig. 6, Pl. CXX.)

(5) Quartz porphyry, Fairfield, Adams County, Pennsylvania. Transparency No. 39078. Section No. 26377.

This rock has essentially the same composition as granite, but is of a markedly different structure owing to the different conditions under which it cooled from a molten mass. The large crystals just below the center and to the left of the top are of quartz, the one on the extreme right feldspar, while the main body of the rock is made up of an intimate mixture of these two minerals in the form known as felsitic. This porphyritic structure is characteristic of a large class of what are known as effusive rocks, and represents two distinct stages of crystallization. The large porphyritic crystals were formed during or prior to the period of eruption, the intratellurial period, while the very fine grained groundmass is due to a more rapid crystallization after the flow had ceased. (See also Fig. 3, Pl. CXX.)

(6) Rhyolite, High Rock Cañon, Nevada. Transparency No. 39079. Section No. 35441.

This rock, like the last, shows porphyritic crystals of quartz in a felsitic groundmass, the quartz being brilliant blue in the transparency. The felsitic groundmass, it will be observed, has a spherulitic structure and also a flow of fluxion structure, giving rise to the nearly parallel banding extending from top to bottom and which is due to the onward flowing of the molten lava while cooling and crystallizing.

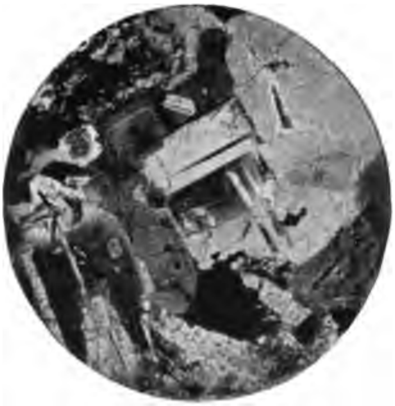
(7) Hornblende Andesite, near Mono Lake, California. Transparency No. 39080. Section No. 35491.

This rock is composed essentialy of the minerals hornblende and plagioclase, the former showing in opaque red and yellow crystals with a dark border, while the plagioclase appears colorless or faintly clouded in large irregular and prismatic forms, often showing a banded or zonal structure somewhat resembling the lines of growth upon the trunk of a tree. The extremely fine grained brownish portion is composed of minute imperfectly formed crystals of both hornblende and feldspar in the form called microlites; hence such a groundmass is called microlitic.

(8) Basalt, Bridgeport, California. Transparency No. 39081. Section No. 25663.

This rock has essentially the same mineral composition as the diabase already decribed, with the addition of olivine. Geologically it is different in having been a surface lava flow and of more recent origin. Observe that the rock is porphyritic and that the groundmass is composed of innumerable small lath-shaped crystals of plagioclase with a small quantity of glassy matter in the interstices. This, as in the quartz porphyries and liparites, denotes two distinct phases of crystallization. Structures of this kind, produced by porphyritic crystals imbedded in a groundmass in part crystalline and in part glassy, are technically known as hypocrystalline porphyritic.

PLATE CXX.



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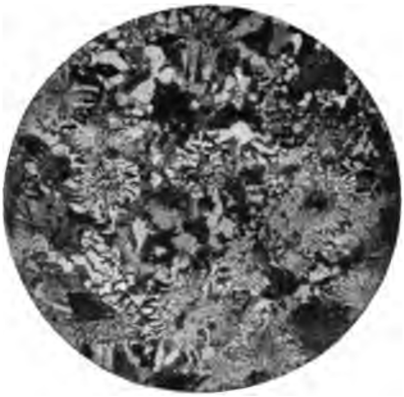

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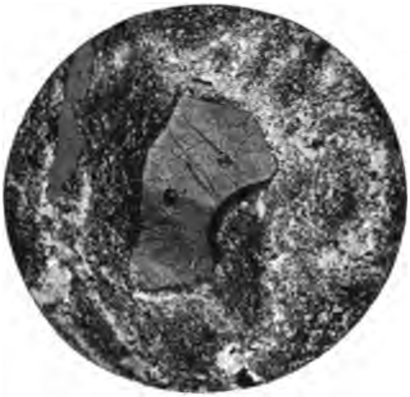

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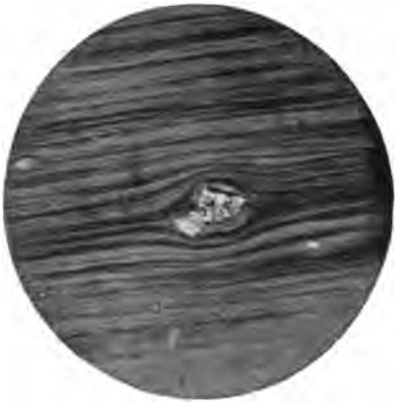

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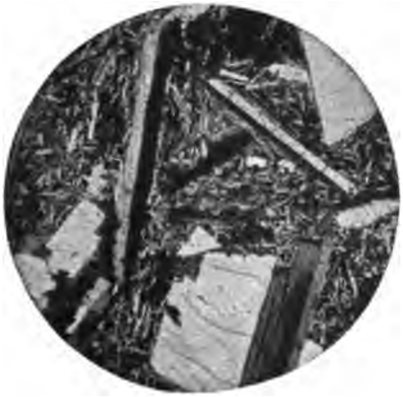

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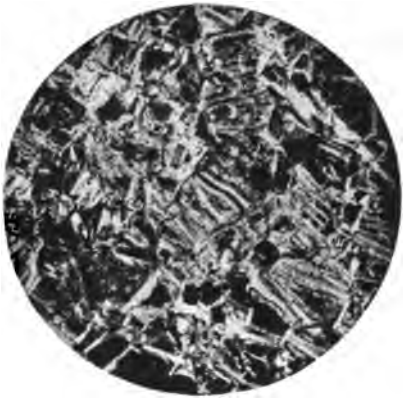

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FIG. 1. Microstructure of granite.
FIG. 2. Microstructure of micropegmatite.
FIG. 3. Microstructure of quartz porphyry.

FIG. 4. Microstructure of porphyritic obsidian.
FIG. 5. Microstructure of trachyte.
FIG. 6. Microstructure of serpentine.

The large cluster of blue, scarlet, and yellowish crystals at the left is augite, the scattering green, crimson, and brownish ones are olivine, while the abundant smaller lath-shaped forms are of feldspar (plagioclase.) Observe that the olivines and augites, being among the first minerals to solidify, have formed, as it were, little islands, around which flowed the still molten magma bearing the lath-shaped feldspars like logs in a millstream.

(9) Gneiss, West Andover, Massachusetts. Transparency No. 39082. Section No. 26595.

This rock has the same composition as granite, but differs in that its constituents are arranged in more or less parallel bands; that is, it has a foliated or schistose structure. This structure was formerly supposed to be due to the fact that such rocks were metamorphic; that they originated from the crystallization of sediments and were not forced up in a molten state, as was the case with granite. While it is very probable that certain of the gneisses may have been formed in this manner, there is little doubt that the foliation in this particular rock is due to dynamic agencies, rather than to original bedding. (See also Plate CXXIV and Fig. 94, p. 547.)

(10) Mica schist, Washington, District of Columbia. Transparency No. 39083.

This rock differs from the last only in the absence of feldspar, being composed wholly of quartz and mica. Like the gneiss it is regarded as a metamorphic rock and possesses a banded structure, which does not show in the transparency, owing to the extremely small part of the rock included.

(11) Sandstone, Portland, Connecticut. Transparency No. 39084. Section No. 26077.

The mineral composition of this stone is quite complex, but the ingredients are essentially those of granite or the gneisses. The colorless portions are quartz or feldspars, the bright iridescent shreds are white mica, the brownish and opaque, black mica, while the opaque material in the interstices is the ferruginous cement.

Observe that instead of a mass of interlocking crystals, as in the cases already described, we have here a confused aggregate of crystalline fragments cemented to form a rock of secondary origin. Such are called classic or fragmental rocks. (See also Fig. 92, p. 536.)

(12) Quartzite or quartz schist. Berks County, Pennsylvania. Transparency No. 39085. Section No. 26478.

Quartzites result from the induration of siliceous sandstones. In some cases the granules are elongated and arranged in nearly parallel layers, giving rise to a schistose structure, as here shown. Composition nearly pure quartz.

## II.—SPECIFIC GRAVITY.

The term specific gravity is used to designate the weight of any substance when compared with an equal volume of distilled water at a temperature of 4° C. This property is therefore dependent upon the specific gravity of its various constituents and their relative proportions. The exact or true specific gravity of a rock may be obscured by its structure. Thus an obsidian pumice will float upon water, buoyed up by the air contained in its innumerable vesicles, while a compact obsidian of precisely the same chemical composition will sink almost instantly. This property of any subject is spoken of as its apparent specific gravity in distinction from the actual comparative weight bulk for bulk of its constituents parts, which could in the case of a pumice be obtained only by finely pulverizing so as to admit the water into all its pores. This difference between the apparent and true specific gravities is illustrated in the three specimens of obsidian pumice, pulverized obsidian pumice, and compact obsidian Nos. 39348 and *39348a*. The first, it will be observed, floats readily owing to the buoyancy of the air included in its vesicles; the second glass contains the same rock pulverized so that all the air-chambers are broken open and the air escapes. The rock fragments consequently sink to the bottom, as does the third of the series (No. 29631), a compact, nonvesicular mass of the same obsidian. Inasmuch as the structural peculiarities of any igneous rock—as will be noted later—are dependent upon the condition under which it cooled, it is instructive to notice that the crystalline aggregates have a higher specific gravity, *i. e.* a greater weight, bulk for bulk, than does a glassy, noncrystalline rock of the same chemical composition. The property is therefore dependent upon chemical (and consequently mineral) composition and structure, and as a very general rule it may be said that among the siliceous rocks those which contain the largest amount of silica are the lightest, while those with a comparatively small amount, but are correspondingly rich in iron, lime, and magnesian constituents, are proportionately heavy.

## III.—THE CHEMICAL COMPOSITION OF ROCKS.

This varies naturally with their mineral composition. It is customary to speak of rocks as calcareous, siliceous, ferruginous, or argillaceous, accordingly as lime, silica, iron oxides or clayey matter are prominent constituents. Among eruptive rocks it is customary to speak of those showing on analysis upwards of 60 per cent. silica as acidic and those showing less than 50 per cent., but rich in iron, lime, and magnesian constituents, as basic. The extremes as will be noted are represented by the rocks of the granite and peridotite groups.

The series illustrating the above-mentioned properties are arranged as below. With the eruptive rocks only the silica percentages are here given. The results of the complete chemical analysis of each variety are given further on, in the pages devoted to their description.

STRATIFIED ROCKS.

| Kind. | Specific gravity. | Composition. |
|---|---|---|
| Calcareous: | | |
| Compact limestone | 2.6 to 2.8 | Carbonate of lime. |
| Crystalline limestone | | |
| Compact dolomite | 2.8 to 2.95 | Carbonate of lime and magnesia. |
| Crystalline dolomite | | |
| Siliceous: | | |
| Gneiss | 2.6 to 2.7 | Same as granite. |
| Siliceous sandstone | 2.6 | Mainly silica. |
| Schist | 2.6 to 2.8 | 60 to 80 per cent. silica. |
| Argillaceous: | | |
| Clay slate (argillite) | 2.5 | Mainly silicate of alumina. |

ERUPTIVE ROCKS.

| | *Specific Gravity.* | *Per cent. silica.* |
|---|---|---|
| Acidic group: | | |
| Granite | 2.58 to 2.73 | 77.65 to 62.90 |
| Liparite | 2.53 to 2.70 | 76.06 to 67.61 |
| Obsidian | 2.26 to 2.41 | 82.80 to 71.19 |
| Obsidian pumice | Floats on water. | 82.80 to 71.19 |
| Intermediate group: | | |
| Syenite | 2.73 to 2.86 | 72.20 to 54.65 |
| Trachyte | 2.70 to 2.80 | 64.00 to 60.00 |
| Hyalotrachyte | 2.4 to 2.5 | 64.00 to 60.00 |
| Andesite | 2.54 to 2.79 | 66.75 to 54.73 |
| Basic group: | | |
| Diabase | 2.66 to 2.88 | 50.00 to 48.00 |
| Basalt | 2.90 to 3.10 | 50.59 to 40.74 |
| Peridotite | 3.22 to 3.29 | 42.65 to 33.73 |
| Peridotite (iron rich) | 3.86 | 23.00 |
| Peridotite (meteorite) | 3.51 | 37.70 |

## IV.—THE COLOR OF ROCKS.

The color of a rock is dependent upon a variety of circumstances, but which may here all be generalized under the heads of mineral and chemical composition and physical condition. Iron and carbon, in some of their forms, are the common coloring substances and the only ones that need be considered here. The yellow, brown, and red colors, common to fragmental rocks, are due almost wholly to free oxides of iron. The gray, green, dull brown, and even black colors of crystalline rocks are due to the presence of free iron oxides or to the prevalence of silicate minerals rich in iron, as augite, hornblende, or black mica. Rarely copper and other metallic oxides than those of iron are present in sufficient abundance to impart their characteristic hues. As a rule, a white or light-gray color denotes an absence of an appreciable amount of iron in any of its forms. The bluish and black colors of many rocks, particularly the limestones and slates, is due to the prevalence of carbonaceous matter.

In still other cases, and particularly the feldspar-bearing rocks, the color may be due in part to the physical condition of the feldspar. Thus, in many rocks, like the norite, from Keeseville, New York (specimen No. 38744), the dark color is due in part to the fact that the feldspar is clear and glassy, allowing the light rays to penetrate it and become absorbed. When such rocks are exposed for a long period to the weather the feldspars frequently undergo a physical change, become soft and porous and no longer absorb the light, but reflect it, giving the stone a white color. These white feldspars, as has been very neatly expressed by the late Dr. Hawes, bear the same relation to the glassy forms as does the foam of the sea to the water itself, the difference in color being in both cases due to the changed physical condition.

The color of rocks, as may be imagined, is not constant, but liable to change under varying conditions, particularly those of exposure. Rocks black with carbonaceous matter will fade to almost whiteness on prolonged exposure, owing to the bleaching out of the coloring materials. Rocks rich in magnetite or free iron oxides, protoxide carbonates, or sulphides, or in highly ferruginous silicate minerals, are likewise liable to a change of color, becoming yellowish, red, or brown, through oxidation of the ferruginous constituents.

In the series shown an endeavor has been made to arrange the rocks in five groups, showing (1) rocks colored by carbonaceous matter; (2) rocks colored by free oxides of iron; (3) rocks colored by the prevalence of iron rich silicates; (4) rocks, the color of which is due in part at least to structural features, and the transparency of the feldspathic constituent; and (5) rocks, the color of which is also in part due to the physical condition of the various constituents, but more particularly to a lack of carbonaceous matter, iron, or other metallic oxides. To this series is appended another, showing the changes in color due (1) to the bleaching of the carbonaceous matter; (2) to the leaching out of the ferruginous oxides by organic acids; (3) to the oxidation of iron protoxide carbonates or sulphides; (4) to a like change in the iron rich silicates; and (5) to a change in the physical condition of the constituent minerals, mainly the feldspars.

I. Colors due to carbonaceous matter:

| | |
|---|---|
| (1) Black. Black marble, Glens Falls, New York. | 26163 |
| (2) Dark gray. Limestone, Schoharie County, New York. | 25909 |
| (3) Blue. Limestone, Murphy, North Carolina. | 9768 |
| (4) Dark gray. Carbonaceous shale, Isere, France. | 38176 |
| (5) Dark gray. Slate, Savoy. | 38194 |

II. Colors due to free iron oxides:

| | |
|---|---|
| (1) Dull brown. Sandstone, Washington County, Kansas. | 56963 |
| (2) Reddish brown. Sandstone, Rusk, Texas. | 35574 |
| (3) Red. Sandstone, Seneca Creek, Maryland. | 60283 |
| (4) Red. Quartzite, Rock County, Minnesota. | 37407 |
| (5) Light red. Volcanic Tuff, Nevada. | 35381 |
| (6) Yellow. Limestone, Wilson, Kansas. | 26482 |

III. Colors due to iron-rich silicate minerals:
- (1) Black. Basalt, coast of Ireland. 37610
- (2) Dark gray. Diabase, York, Pennsylvania. 37020
- (3) Red. Granite (color due to red feldspar), Otter Creek, Mount Desert, Maine. 35923
- (4) Pink, green spotted. Granite (color due to pink feldspar and green epidote), Dedham, Massachusetts. 26386
- (5) Black. Amphibolite (color due to dark hornblende), Baltimore County, Maryland. 26857
- (6) Dark green. Serpentine, Easton, Pennsylvania. 70109
- (7) Yellow. Serpentine, Montville, New Jersey. 69198

IV. Color due in part to transparency of mineral constituents, principally feldspars:
- Dark greenish black. Norite, Keeseville, New York. 38744

V. Colors due mainly to the physical condition of the various constituents and a lack of metallic oxides or other coloring material.
- (1) White. Chalk. England.
- (2) White. Crystalline limestone, Loudoun County, Virginia. 38568

VI. Change in colors due to causes above enumerated.
- (1) From black to dull red-brown caused by oxidation of magnetite and iron rich silicates. Diabase. Lewiston, Maine. Two samples. 70661
- (2) From pure white to dull red, caused by oxidation of ferrous carbonates. White limestone. Newbury, Massachusetts. 73037
- (3) From dark gray to buff, caused by oxidation of pyrite and iron protoxide.
- (4) From pink to dirty white, caused by a bleaching out and change in the physical condition of the feldspathic constituent (commencement of kaolinization). Granite. Washington County, Maine. 25873
- (5) From reddish brown to gray, caused by a removal of coloring matter (iron oxide) by decomposing organic matter. Sandstone. Marquette, Michigan. 70659

Luster as a property of rocks does not, owing to their complex character, possess the same value, as a characteristic, as among minerals. Nevertheless, as there are certain of the more compact and homogeneous varieties which possess characteristic lusters, these may perhaps be well shown here. The exhibit is arranged as follows:

| | |
|---|---|
| (1) Vitreous luster | Quartzite; Obsidian. |
| (2) Greasy luster | Serpentine. |
| (3) Pearly luster | Steatite. |
| (4) Metallic luster | Hematite. |
| (5) Iridescent luster | Coal. |
| (6) Dull, no luster | Chalk. |

The fracture or manner of breaking of any rock is dependent more upon structure than chemical or mineralogical composition. Many fine, even-grained crystalline or fragmental rocks break with a smooth, even surface and are spoken of as having a straight or even fracture; others, and particularly the very compact fine-grained varieties, break with shell-like concave and convex surfaces, and are said to have a conchoidal fracture. Still others have splintery, hackly, shaly, friable, or pulverulent fractures. These characteristics, being of value in determining the working properties of the stones, are dwelt upon more fully in the hand-book relating to the collection of building and ornamental stones.

### (4) THE KINDS OF ROCKS.

In the present transitional state of our knowledge regarding the chemical and mineralogical composition of rocks, their structural features, and methods of origin, no scheme of classification can be advanced that will prove satisfactory in all its details. The older systems which were made to answer before the introduction of the microscope into geological science are now found to be founded upon what were in part false, and what have proven to be wholly inadequate data. This is especially true in regard to eruptive rocks. The time that has elapsed since this introduction has been too short for the evolution of a perfectly satisfactory system; many have been proposed, but all have been found lacking in some essential particular. To enter upon a discussion of the merits and demerits of the various schemes would obviously be out of place here, and the student is referred to the published writings of Naumann, Senft, Von Cotta, Richtofen, Vogelsang, Zirkel, Rosenbusch, and Geikie, as well as those of the American geologists Dana* and Wadsworth.† In the scheme here presented the Curator has aimed to simplify matters as much as possible, and has not hesitated to adopt or reject any such portions of systems proposed by others as have seemed desirable.

All the rocks forming any essential part of the earth's crust are here grouped under four main heads, the distinctions being based upon their origin and structure. Each of the main divisions is again divided into groups or families, the distinctions being based mainly upon mineral and chemical composition, structure, and mode of occurrence. We thus have:

I. *Aqueous rocks.*—Rocks formed mainly through the agency of water as (A) chemical precipitates or as (B) sedimentary beds. Having one or many essential constituents; in structure laminated or bedded; crystalline, colloidal or fragmental, never glassy.

II. *Æolian rocks.*—Rocks formed from wind-drifted materials. In structure irregularly bedded; fragmental.

III. *Metamorphic rocks.*—Rocks changed from their original condition through dynamic or chemical agencies, and which may have been in part of aqueous and in part of igneous origin. Having one or many essential constituents. In structure bedded, schistose, or foliated.

IV. *Igneous rocks. Eruptive.*—Rocks which have been brought up from below in a molten condition, and which owe their present structural peculiarities to variations in conditions of solidification and composition. Having as a rule two or more essential constituents. In structure massive, crystalline, felsitic or glassy, or in certain altered forms, colloidal.

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* On some points in Lithology, Am. Jour. Sci., vol. XVI, 1878, pp. 335 and 431.

† On the classification of rocks. Bull. Mus. Comp. Zool. Howard College, No. 13, vol. V.; also Lithological Studies.

The following shows the types of labels used in this collection:

**HORNBLENDE-BIOTITE GRANITE.**

NEAR SALT LAKE CITY, Utah. 39,095.
Gift of G. K. GILBERT, 1887.

**PERIDOTITE: Dunite.**

Near WEBSTER, Jackson County, North Carolina. 39,131.
Gift of W. A. H. SCHREIBER, 1887.

**QUARTZITE [Novaculite].**

LEIGH RIVER, Victoria, Australia. 28,321.
AUSTRALIAN CENTENNIAL COMMISSIONERS, 1876.

The inclosing a name in brackets, as [Novaculite] in the last form, indicates that it has gone out of use, or is a local or popular name of little value and not generally accepted.

## I.—AQUEOUS ROCKS.

### A.—ROCKS FORMED AS CHEMICAL PRECIPITATES.

This comparatively small though by no means unimportant group of rocks comprises those substances which, having once been in a condition of vapor or aqueous solution, have been deposited as rock masses either by cooling, evaporation, by a diminution of pressure, or by direct chemical precipitation. It also includes the simpler forms of those produced by chemical changes in preëxisting rocks. Water, when pure or charged with more or less acid or alkaline material, and particularly when acting under great pressure, is an almost universal solvent. Thus heated alkaline waters permeating the rocks of the earth's crust at great depths below the surface are enabled to dissolve from them various mineral matters with which they come in contact. On coming to the surface or flowing into crevices the pressure is diminished or evaporation takes place and the water, no longer able to carry its load, deposits it wholly or in part as vein material or a surface coating. In other cases alkaline or acid water bearing mineral matters may in course of their percolations be brought in contact with neutralizing solutions and these dissolved materials be thus deposited by direct precipitation. In still other instances a substance wholly or in part volatile may, when buried at considerable depths below the surface, be subjected to such temperature as shall cause it to assume a gaseous state and pass upwards until a cooler stratum is reached where it is again deposited. In these various ways were formed the rocks here shown.

This group can not, however, be separated by any sharp lines from that which is to follow, inasmuch as many rocks are not the product of a single agency acting alone, but are rather the result of two or more combined processes. This is especially the case with the limestones. It is safe to assume that few of these are due wholly to accumulations of calcareous organic remains, but are in part, at least, chemical precipitates, as is well illustrated by the oolitic varieties.

According to their chemical nature the group is divided into (1) Oxides, (2) Carbonates, (3) Silicates, (4) Sulphur, Sulphides, and Sulphates, (5) Phosphates, (6) Chlorides, and (7) the Hydrocarbon Compounds.

(1) OXIDES.—Here are shown those rocks consisting essentially of oxygen combined with a base, though usually other constituents are present as impurities.

(*a*) Red hematite. Specular iron ore. Iron sesquioxide $Fe_2 O_3$=iron 70 per cent., oxygen 30 per cent. This is a fibrous, scaly, or massive rock of a black, brownish, or blood-red color, and which consists essentially of iron oxide, but often carries more or less clayey and siliceous matter. It occurs in extensive beds among the older formations of the earth's crust and forms a valuable ore of iron. It is represented in the series by but a few characteristic specimens. The visitor is referred to the ore collections for a more complete series of these and of the limonites which follow.

(*b*) Limonite. Brown hematite. Iron sesquioxide plus water. ($Fe_2 O_3$ + aq.): An earthy or compact dark brown, black, or ocherous-yellow rock, containing, when pure, about two-thirds its weight of pure iron. It occurs in beds, veins, and concretionary forms, associated with rocks of all ages, and forms a valuable ore of iron. (See Fig. 1, Pl. CXXII.) On the bottoms of lakes, bogs, and marshes it oftens forms in extensive deposits, where it is known as bog iron ore. The formation of these deposits, as described by Dr. Hunt,* is as follows: Iron is widely diffused in rocks of all ages, chiefly in the form of (1) the protoxide which is readily soluble in waters impregnated with carbonic or other feeble acids, or (2) the peroxide which is insoluble in the same liquids. Water percolating through the soils becomes impregnated with these acids from the decomposing organic matter, and then dissolves the iron protoxide with which it comes in contact. On coming to the surface and being exposed to the air as in a stagnant lake or marsh, this dissolved oxide absorbs more oxygen, becoming converted into the insoluble sesquioxide and floats on the surface as an oil-like iridescent scum. Finally it sinks to the bottom, where it gradually becomes aggregated as a massive iron ore. This same ore may also form through the oxidation of pyrite or beds of ferrous carbonate. At the Katahdin Iron Works in Piscataquis County, Maine, the pyrite as it oxides is brought to the surface by water and deposited as a coating over the leaves and twigs

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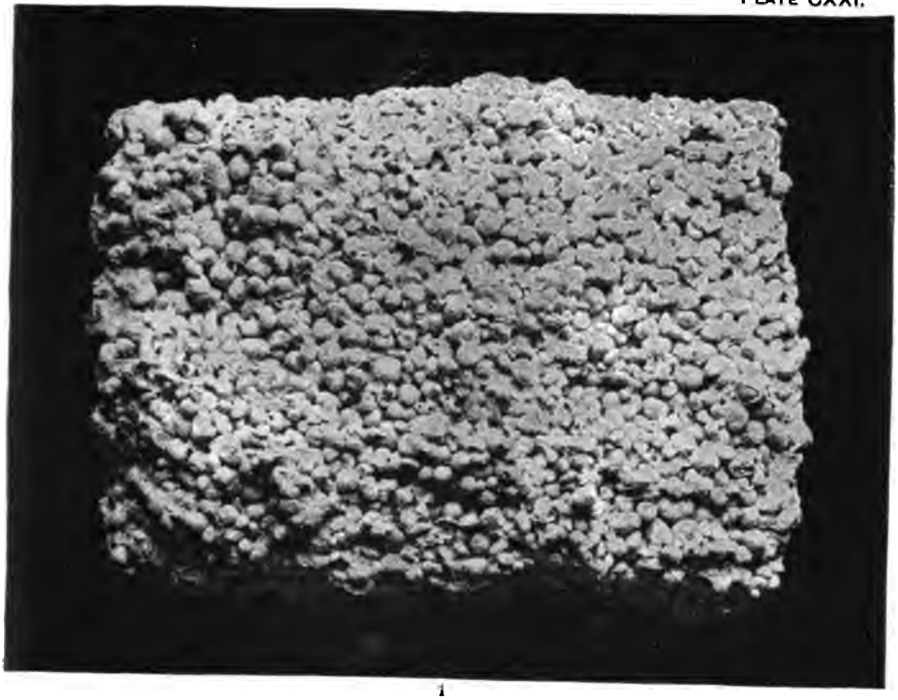
* Chemical and Geological Essays.



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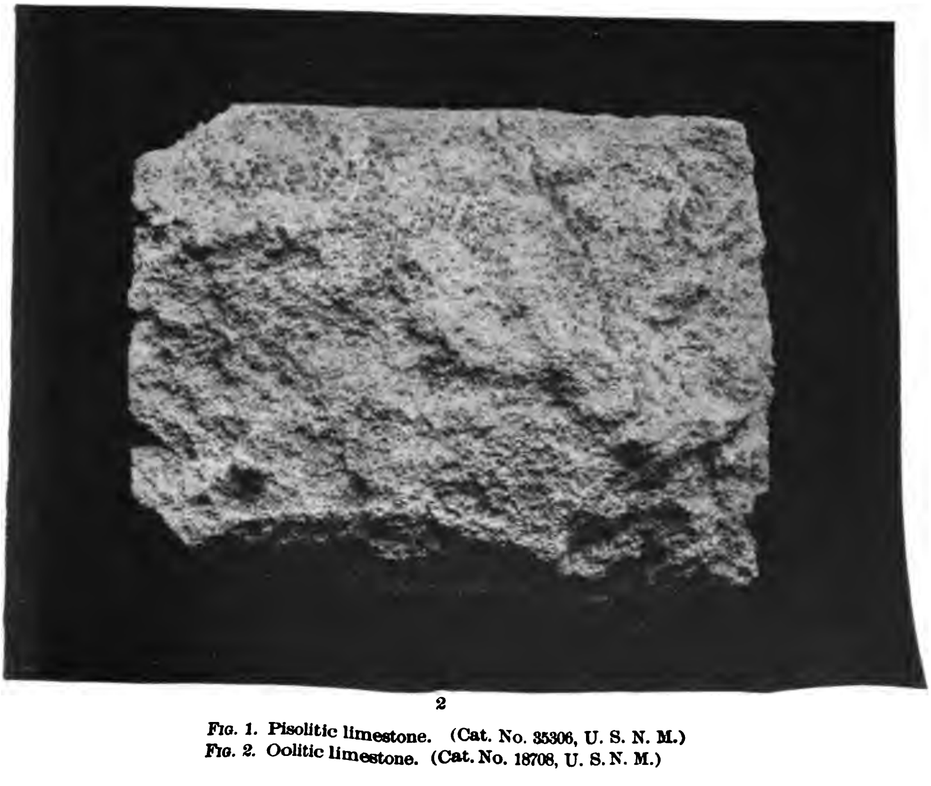

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FIG. 1. Pisolitic limestone. (Cat. No. 35306, U. S. N. M.)
FIG. 2. Oolitic limestone. (Cat. No. 18708, U. S. N. M.)

scattered about, forming thus beautifully perfect casts or fossils, as shown in specimen No. 35969.

(*c*) Pyrolusite, psilomelane, and wad: These are names given to the anhydrous and more or less hydrated forms of maganese oxides, and which, though wide in their distribution, are found in such abundance as to constitute rock masses in comparative rarity. As with the iron oxides, but a few forms are exhibited here, and the visitor is referred to the economic section for a more complete display.

(*d*) Beauxite (so called from Beaux, near Arles, France), is the name given to a somewhat indefinite mixture of alumina and iron oxides, and occurring in the form of compact concretionary grains of a dull red, brown or nearly white color. The origin of the rock is at present somewhat obscure, but it is considered by M. Auge* as a deposit from hot springs and geysers. The following analyses given by this authority show the variations in composition:

| | Per cent. | Per cent. |
|---|---|---|
| Alumina | 69.30 | 76.90 |
| Iron oxides | 22.90 | 0.10 |
| Titanium oxide | 3.40 | 4.00 |
| Silica | 0.30 | 2.20 |
| Water | 14.10 | 15.80 |

The rock is at present represented by specimens from Thoronet, France (10739), and Floyd County, Georgia (66576 and 66578).

(*e*) Silica: Silica, as has already been noted under the head of rock-forming minerals, is one of the most abundant constituents of the earth's crust. In its various forms, which are sufficiently extensive to constitute rock masses, it is always of chemical origin; that is, results by deposition from solution, by precipitation, or evaporation, as noted above. Varietal names are given to the deposits, dependent upon their structure, method of formation, color, and degree of purity. Siliceous Sinter, or "Geyserite," is the name given to the nearly white, often soft and friable hydrated varieties formed on the evaporation of the siliceous waters of hot springs and geysers, or through the eliminating action of algous vegetation, as described by W. H. Weed. The specimens from Yellowstone National Park (Nos. 12876, 12888, 17848, 18965, 28945, 28946, 28948, 28981, 28982, 35521, 36782, 72844, 72845, and 72882), Iceland (2548), and New Zealand (70338, 70340, and 70341), are characteristic.

Opal and semi-opal are also hydrous forms of silica occurring in veins and pockets in a variety of rocks. These varieties are shown in specimens from the Yellowstone National Park (36150); Buffalo Peaks, Colorado (69185); Rapides Parish, Louisiana (38612); Mexico (57985), and Hungary (6963). The variety known as wood opal, formed by the silicification of wood, is shown in No. 37042 from Wyoming, and in the two pieces from the Pliocene beds on the Madison River, Gallatin County, Montana (38567).

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* Bulletin Geological Society of France, 3d, xvi, 1888, No. 5, p. 345.

Jasper is a dull or bright red or yellow variety of silica containing alumina, and owing its color to iron oxides. Characteristic forms are shown in specimens from Colorado and Montana (10374, 10397, and 38572).

Chalcedony is a translucent, massive variety occurring mainly in cavities in older rocks where it has been deposited by infiltration. The specimens from Montana (38605) and Cuba (36146) are common forms. No. 70064 from Webster, Jackson County, North Carolina, is a cellular variety formed in seams in dunite rocks during the decomposition of the olivine; No. 36051 and 36140 are somewhat similar varieties from Sebastopol, Georgia, and Jonarre, France, used for buhrstones in grinding grain. Specimens 35599 and 36010 from Wyoming and Colorado are silicified woods partaking of the character of chalcedony rather than opal, as in the cases above mentioned.

Flint is a variety of chalcedony formed by segregation in chalky limestones, and composed in part of the broken and partially dissolved spicules of sponges and the remains of infusoria. Chert is an impure flint containing frequently fossil nummulitic remains (26581), and with sometimes an oölitic structure; oölitic varieties, such as that from Centre County, Pennsylvania (70606) are not common. The variety flint is shown by a characteristic sample from the English chalk beds (36012). The cherts are illustrated by specimens from Kansas (26581); Missouri (17598); Texas (70429); Nevada (21762), and Pennsylvania (70127).

The name novaculite is frequently given to very fine grained and compact quartz rocks, such as are suitable for hones. As commonly used the name is made to include rocks of widely different origin, some of which are evidently chemical precipitates, while others are indurated clastic or schistose rocks. Here are placed the well known "novaculites" of Arkansas, which are considered by authorities to be altered cherts (specimens 4307, 27833, and 39109).

Quartz is a massive form of crystalline silica occurring in veins, disseminated granules, and pockets in rocks of all kinds and all ages. It is often colored pink or reddish by iron oxides. Many other varieties of silica occur, but are not sufficiently abundant to constitute rock masses, and are to be found in the collection of the mineral department. It is represented here by specimens from Auburn, Maine (37613); Bedford, New York (36058); Lake Superior, Michigan (4260); Sawatch Mountains, Colorado (35896); Godhaven, Greenland (34947); Brazil (4092), and Freiberg, Saxony (3836).

Lydian stone is an exceedingly hard impure quartz rock of a black color and splintery fracture. It was formerly much used in testing the purity of precious metals. (Specimen 3820 from Frankenberg, Saxony.)

(2) CARBONATES.—Water carrying small amounts of carbonic acid readily dissolves the calcium carbonate of rocks with which it comes in contact, taking it up in the form of bicarbonate; on evaporation this

is again deposited as carbonate. In this way are formed numerous and at times extensive deposits, to which are given varietal names dependent upon their structure and the special conditions under which they originated. Calc sinter or tufa is a loose friable deposit made by springs and streams either by evaporation or through intervention of algous vegetation.* Such are often beautifully arborescent and of a snow-white color, as seen in specimens 12882, 72871, and 72876, from the Mammoth Hot Springs of the Yellowstone National Park. Somewhat similar deposits are shown from springs in Virginia (35759); California (29637); Mexico (37787), and New Zealand (70335). Others, like those from Niagara Falls, New York, and Soda Springs, Idaho (36107, 39136), were formed by the deposition of the lime on leaves and twigs, forming beautifully perfect casts of these objects.

Tufa deposits of peculiar imitative shapes have been described by Mr. I. C. Russell of the U. S. Geological Survey, as formed by the evaporation of the waters of Pyramid Lake, Nevada (35260). See, also, collection from Lake Lahanton, Nevada, in floor upright case). Oolitic and pisolitic limestones are so called on account of their rounded fish-egg-like structure, the word oölite being from the Greek word *ωον*, an egg. (See Pl. CXXI.) These are in part chemical and in part mechanical deposits. The water in the lakes and seas in which they were formed became so saturated that the lime was deposited in concentric coatings about the grains of calcareous sand on the bottom, and finally the little granules thus formed became cemented into firm rock by the further deposition of lime in the interstices. This structure will be best understood by reference to Fig. 91. Samples are shown such as are now forming in Pyramid Lake, Nevada (No. 35378); Cache Valley, Utah (35305 and and 35306); Great Salt Lake, Utah (35379), and Key West, Florida (18708), and from other geological formations of America and Europe (Nos. 36115 and 36960). Only those which are largely chemical are here shown; others are to be found in the group of stratified rocks.

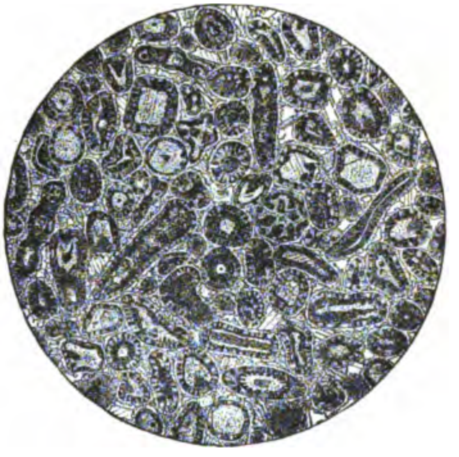

FIG. 91.

MICRO-STRUCTURE OF OOLITIC LIMESTONE.

(Princeton, Kentucky.)

Travertine is a compact and usually crystalline deposit formed, like the tufas, by waters of springs and streams. The travertines are often beautifully veined and colored by metallic oxides and form some of the finest marbles (Specimen 39071 from Mexico; 38445 from Suisin City, California; 37269, Idaho; and 38811, Tivoli, Rome, Italy. See, also, collection of building and ornamental stones).

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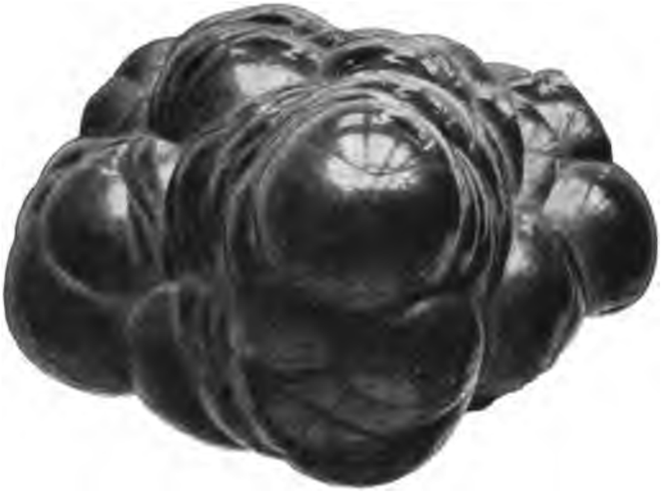
* See Mr. Weed's paper on the Formation of Travertine and Siliceous Sinter, Annual Report United States Geological Survey for 1887-'88.

Stalactite and stalagmite are the names given to the deposits formed from the roofs and on the floors of caves; shown by specimens from the rock of Gibralter (36769 and 38444) and from the Luray Caves in Virginia (35549). See also floor upright case on north side of hall.

Magnesite, a carbonate of magnesia, occurs frequently as a secondary mineral in the form of veins in serpentinous rocks (specimens 70158 from Lancaster County, Pennsylvania; 70678, Wells Island, New York; and 28464, Victoria, Australia).

Rhodochrosite, a carbonate of manganese, sometimes occurs in rock masses, but is found most commonly in the form of veins associated with ores of silver, lead, or copper (specimen 26745 from Walkerville, Montana). Another carbonate, less common than that of lime, but which sometimes occurs in such quantities as to constitute true rock masses, is siderite, or carbonate of iron. A common form of this is dull brownish or nearly black in color, very compact and impure, containing varying amounts of calcareous, clayey and organic matter. In this condition it is found in stratified beds and in the shape of rounded and oval nodules, or concretions, which are called "clay-iron-stone" nodules, "septaria," and "sphærosiderite" (specimen 12840 from Wakonda, Kansas; see, also, Fig. 2, Pl. CXXII). These septarian nodules are often beautifully veined with calcite (see concretion collection). Other forms of siderite, like those from Connecticut (36105) and Saxony (3810 and 39073), are massive, coarsely crystalline, and of a nearly white or yellowish color, becoming brownish on exposure. Pure siderite yields about 48 per cent. metallic iron, and is a valuable ore. As with the other ores of iron, but a few characteristic specimens are here exhibited, and the visitor is referred, as before, to the ore series for a more complete display.

(3) SILICATES.—Silica (oxide of silicon) combined with magnesia and water gives rise to an interesting group of serpentinous and talcose substances, which are often sufficiently abundant to constitute rock masses. Pure serpentine consists of about equal parts of silica and magnesia, with from 12 to 13 per cent. of water. It is a compact, amorphous or colloidal rock, soft enough to be cut with a knife, of a slight greasy feeling and luster, and of a color varying from dull greenish and almost black, through all shades of yellow, brownish, and red. It also occurs in fibrous and silky forms, filling narrow veins in the massive rocks, and is known as amianthus, or chrysolite. These fibers, when sufficiently long, are used for the manufacture of fireproof material, and the mineral is commercially confounded with asbestus, a fibrous variety of hornblende (specimen 37645 from Canada). It is very doubtful if serpentine is ever an original rock, but is always derived from the alteration of other and less stable magnesian minerals. Here are exhibited



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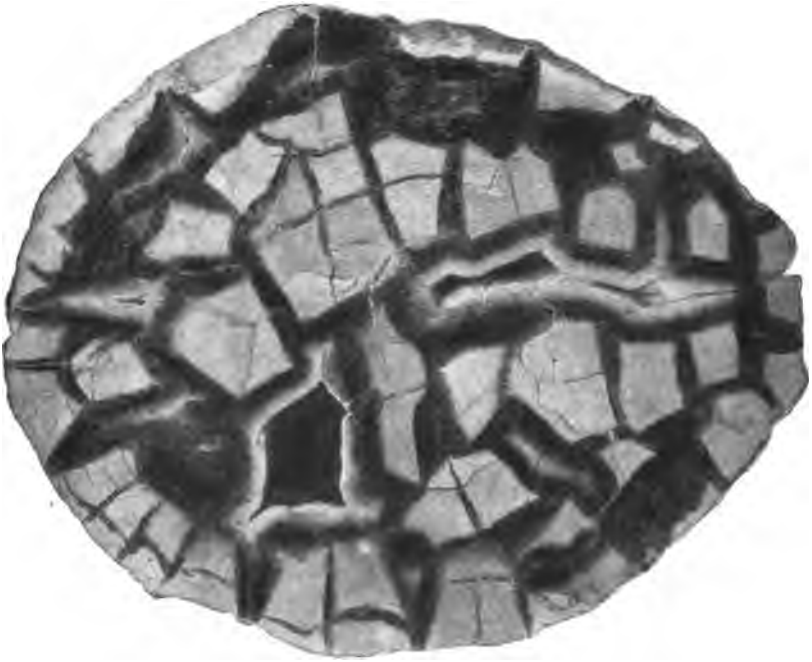

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FIG. 1. Botryoidal hematite. (Cat. No. 36085, U. S. N. M.)
FIG. 2. Clay-iron stone septarian nodule. (Cat. No. 12840. U. S. N. M.)

only those which have originated by a series of chemical changes known as metasomatosis, a process of indefinite substitution and replacement, in simple mineral aggregates occurring associated with the older metamorphic rocks. Such are the serpentines derived from nonaluminous pyroxenes, like those of Montville, New Jersey (39038), and Moriah, New York (70084), and those from Easton, Pennsylvania, derived from a massive tremolite rock (70109).

Several varieties of serpentine are popularly recognized. *Precious* or *noble* serpentine is simply a very pure compact variety of a deep oil-yellow or green color (39038). *Amianthus*, or *chrysolite*, as noted above, is the name given to the fibrous variety (37645). *Williamsite* is a deep bright green, translucent, and somewhat scaly granular variety, occurring associated with the chrome iron deposits in Fulton Township, Lancaster County, Pennsylvania (36041). *Deweylite* is a hard, translucent variety occurring in veins in altered dunite beds. *Bowenite* is a pale green variety forming veins in limestone at Smithfield, Rhode Island (36763). *Picrolite*, *Marmolite*, and *Retinolite*, are varieties of minor importance, and may be found in the mineral collections. Serpentine alone, or associated with calcite and dolomite, forms a beautiful marble, to which the names verdantique, ophite, and ophiolite are given. (See Building and Ornamental stones.) The name serpentine is from the Latin *serpentinus*, a serpent, in allusion to its green color and often mottled appearance. The so-called "Eozoon Canadense," a supposed fossil rhizopod, is a mixture of serpentine and calcite or dolomite (specimen 70434 from Cote St. Pierre, Canada). Those serpentines which were derived from basic eruptives or complex metamorphic rocks are exhibited with those rocks with which, in their unaltered state, they would naturally be grouped.

The mineral steatite or talc, when pure, differs from serpentine in containing 63.5 per cent. of silica to 31.7 per cent. magnesia and 4.8 per cent. of water. Its common form is that of white or greenish inelastic scales, forming an essential constituent of the talcose schists. As is the case with serpentine it sometimes results from the alteration of eruptive magnesian rocks such as the pyroxenites.

Here are exhibited but a few forms occurring in veins or masses indicative of an origin by chemical deposition. Specimen 39088 is a compact variety occurring in the form of veins in the limestones of Thomaston and Rockland, Maine. Nos. 36135 and 27654 are schistose forms from New York and North Carolina. Rensselaerite is a related variety from St. Lawrence County, New York (specimen 36117). Pyrophyllite or agalmatolite is a hydrous silicate of alumina, somewhat harder than talc, and extensively used in making slate pencils and small images (specimen 37812 from Mexico and 27562 from Japan).

Kaolin, also a hydrous silicate of alumina, is a chemical product in that it is a residue left by the chemical decomposition of the feldspars. These minerals, as explained elsewhere, consist of silicates of alumina, lime, and magnesia with more or less of the alkalies, potash, and soda, and iron oxides. In the process of decomposition these soluble portions are leached out leaving the less soluble silicate, or kaolin, behind in a condition of more or less purity. The mineral is of great value for fictile purposes, and a larger number of localities are represented in the economic series in the southwest court. Other and more impure varieties in the form of clay are to be found with the fragmental rocks. But a few samples from North and South Carolina (39028 and 70172) and the Yellowstone National Park are here shown. That from the Yellowstone is thrown up in the form of a thick mud by hot springs (specimen 12879).

(4) SULPHUR, SULPHIDES, AND SULPHATES.—The mineral sulphur sometimes occurs in nature in such masses as to be fairly entitled to consideration as a rock. Its mode of occurrence has been already described under the head of chemical elements constituting rocks. In combination with iron, copper, lead, zinc, and other metals forming sulphides, it is an important rock constituent, and often occurs in beds or veins of such dimensions as to constitute a valuable ore. In combination with oxygen and the metals it forms sulphates. Gypsum, the hydrous sulphate of calcium, is a soft, white, yellowish, or pink rock, resulting mainly as a chemical deposit from the evaporation of sea water, although, as stated by Geikie (see p. 121), it may originate through the decomposition of sulphides and the action of the resultant sulphuric acid upon limestone; through the mutual decomposition of the carbonate of lime and sulphates of iron, copper, etc.; through the hydration of anhydrate, or through the action of sulphurous vapors and solutions from volcanoes acting upon the rocks with which they come in contact. It occurs in beds belonging to various geological horizons, and is usually associated with clay, rock salt, and anhydrate.

Alabaster is a fine white variety of gypsum used in smaller works of art. (Specimens 36872 and 38817.)

Anhydrite is an anhydrous variety of calcium sulphate, somewhat less common than gypsum. Barite or "Heavy Spar," the sulphate of barium, also occurs in nature, but less abundantly than the calcium sulphates.

The following localities and varieties are represented:

Sulphur:

Tehama County, California, 30118; Rabbit Hole Sulphur Mines, Humboldt County, Nevada, 35511 and 35512; Cove Creek, Utah, 35513 (7 specimens); Hell Roaring Mountain, Yellowstone National Park (72877); Murcia Province, Spain, 4246; Volcano of Popocatepetl, Mexico, 64773.

Sulphides:

Sulphide of iron. Deer Isle, Maine, 36021.

Sulphide of zinc. Deer Isle, Maine, 36016; Madison County, New Hampshire, 70094; Joplin, Missouri, 65262.

Sulphides of copper and iron. Gilpin County, Colorado, 15983; Ascension Island, 72950.

Sulphide of lead. Missouri, 39072; Brittany 6825.

The sulphides although of minor importance as rock masses are of the very greatest importance as ores, in which collections the visitor will find a very full series.

Sulphates:

Anhydrite. Isere, France, 38197; Boisset, France, (with gypsum) 38214; Volpino, Bergamo, Italy, 36733; La Graz, Mt. Blanc, 36114; Nova Scotia, 36102.

Gypsum:

Grand Rapids, Michigan, 35590; North Ogden Cañon, Colorado, 36771; Windsor, Nova Scotia, 13690 and 37624; State of Pueblo, Mexico (Satin Spar), 37815; Argentine Republic, 35531; Galica, Austria, 38817.

Barite or sulphate of barium. Vangueray, France, 38198. Alunite, or sulphate of aluminum and potash. Hungary, 36034.

(5) PHOSPHATES.—The mineral apatite, a phosphate of lime as already noted is a common accessory in the form of small crystals in crystalline rocks of all ages. It also sometimes occurs in the form of crystalline granular aggregates constituting true rock masses associated mainly with the older rocks of the earth's crust. It is therefore given a limited space here. The following localities are represented: Apatite mines of Bamle, Norway, 18873; Burgess, Ontario, Canada, 36128; France, 38143. (See also mineral fertilizers in economic series.)

(6) CHLORIDES.—Sodium chloride, or common salt is one of the most common constituents of the earth's crust. From an economic standpoint it is also a most important constituent. It occurs in greater or less abundance in all natural waters, and as a product of evaporation of ancient seas and lakes it occurs in beds of varying extent and thickness among rocks of all ages wherever suitable circumstances have existed for their formation and preservation. Salt beds from upwards of a few inches to 30 feet in thickness occur in New York State and Canada, while others abound in Pennsylvania, Virginia, Ohio, Michigan, and Louisiana. There are also numerous surface deposits of great extent in the arid regions of the West. The chlorides are here illustrated only by specimens from Lincoln County, Nevada (15501); New Iberia, Louisiana (38461).

(7) THE HYDROCARBON COMPOUNDS.—Here are brought together a small series of rocks consisting as do the mineral coals of carbon in combination with hydrogen and sometimes oxygen, and which are regarded as products of distillation or chemical alteration of buried organic matter, both plant and animal. Many compounds of the series are of a gaseous nature (natural gas, etc.,) and hence not applicable for exhibition purposes. Several members of this group are of great importance from an economic standpoint and a more complete display is given in the room devoted to economic geology (southwest court).

Petroleum is a mixture of natural hydrocarbons, liquid at ordinary temperatures and with a specific gravity somewhat less than that of water. In color it varies from nearly colorless through greenish to black. (See color series in southwest court.) But two samples are here exhibited, one (59867) from Washington, Pennsylvania, and the second (59853) from Aurelius, Ohio.*

The name paraffine is given to a wax-like hydrocarbon obtained by a process of distillation from petroleum, and occurring sparingly native.

Ozokerite is also a wax-like hydrocarbon compound occurring sparingly in seams in rocks and sometimes associated with beds of coal or other bituminous products. It is used mainly as a substitute for beeswax and as an insulator. But two localities are here represented, Utah (No. 67265) and Galicia, Austria (No. 12908). Asphaltum or bitumen is an amorphous mixture of hydrocarbons, derived presumably from decomposing organic matter, but belonging to rocks of no particular geological horizon. It has been found in gneissic rocks in Sweden. Specimen No. 27832 is from the Niagara limestones underlying Chicago, Illinois. No. 10678 is from the so-called Pitch Lake on the island of Trinidad, No. 66590 from Cuba, and No. 59345 from Scotland.

Albertite and grahamite are names given to closely related, coal-like, hydrocarbons occurring in pockets and veins, and which are supposed to have originated by the distillation of carbonaceous matter in the underlying shales. (Specimens Nos. 36138 and 59924 from Nova Scotia and West Virginia.)

Amber and gum copal are vegetable resins altered by fossilization. They are used for jewelry (see gem collection southwest range) and in the manufacture of varnishes.

### B.—ROCKS FORMED AS SEDIMENTARY DEPOSITS AND FRAGMENTAL IN STRUCTURE.

The rocks of this group differ from those just described in that they are composed mainly of fragmental materials derived from the breaking down of older rocks, or are but the more or less consolidated accumulations of organic and inorganic débris from plant and animal life. The group shows transitional forms into the last as will be illustrated by certain of the limestones and the quartzites. They are water deposits, and as a rule are eminently stratified or bedded, although this structure is not always apparent in the hand specimen owing to its small size.

This great group of nonmetamorphic sedimentary rocks is one of the most important in geological science, since it is by means of the still unchanged organic forms (fossils) they contain that the paleontologist has been enabled to study the past history of the globe, to discover the multitudinous changes which have taken place in the climate, character of life on land and sea, and the changes in the surface of the land itself from the earliest time down to the most recent. (See Geikie, pp. 158-176.)

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* Under the title of "The Trenton Limestones as a source of petroleum and natural gas in Ohio and Indiana" (Ann. Rep. U. S. Geol. Survey, 1886-87, part II, pp. 483-662), Prof. Edward Orton gives a most instructive summary of our knowledge on these subjects, and to this paper those desiring further information are referred.

As will be readily comprehended when we consider from what a multitude of materials the fragmental rocks have been derived, the amount of assorting, admixture with other substances, solution, and transportation by streams these materials have undergone, they can not be classified by any hard and fast lines, but one variety may grade into another, both in texture and structure as well as chemical composition, almost indefinitely. Indeed many of them can scarcely be considered as more than indurated mud, and only very general names can be given them.

Accordingly as these rocks consist of mechanically formed inorganic particles of varying composition and texture, or of the more or less fragmental débris from plant and animal life, they are here divided into two main groups, each of which is subdivided as below:

(A) Rocks formed by mechanical agencies and mainly of inorganic materials.

1. *The arenaceous group—Psammites.*—Sand, gravel, sandstone, conglomerate, and breccia.

2. *The argillaceous group—Pelites.*—Kaolin, clay, wacke, shale, clayey marl, argillite.

3. *The calcareous group.*—Arenaceous and brecciated limestones. The rocks of this group are often in part organic and in part chemical deposits. Only those are placed here in which the fragmental nature is the most pronounced characteristic.

4. *The volcanic group.*—Fragmental rocks composed mainly of ejected volcanic material. Tuffs, lapilli, sand and ashes, pumice dust, trass, peperino, pozzulano, etc.

5. *The ferruginous group.*—Fragmental iron ores, hematites, limonites, etc.

(B) Rocks formed largely or only in part by mechanical agencies and composed mainly of the débris from plant and animal life. Organagenous.

1. *The siliceous group.*—Infusorial earth.

2. *The calcareous group.*—Fossiliferous and oolitic limestone, marl, shell sand, shell rock.

3. *The carbonaceous group.*—Peat, lignite, coals, bitumen, oil shale, etc.

4. *The phosphatic group.*—Phosphatic sandstone, guano, coprolite nodules.

### A.—ROCKS COMPOSED MAINLY OF INORGANIC MATERIALS.

1. *The arenaceous group—Psammites.*—Arenaceous from the Latin *arenaceus*, sandy or sand-like. Psammite from the Greek *Ψαμμιτης* sandy.

These rocks are composed mainly of the siliceous materials derived from the disintegration of older crystalline rocks and which have been rearranged in beds of varying thickness through the mechanical agency of water. They are, in short, consolidated beds of sand and gravel. In composition and texture they vary almost indefinitely. Many of them having suffered little during the process of disintegration and transportation, are composed of essentially the same materials as the rocks from which they were derived. This is the case with the arkose shown in specimens 39052 and 38135 from Rhode Island and France, and the red Triassic sandstone shown in specimen No. 70067 from Colorado. All of these were derived from granitic rocks and like them consist of quartz, feldspar, and mica. Others, in which the fragmental materials suffered more prior to their final consolidation, have had the softer and more soluble minerals removed, leaving the sand composed mainly of the hard, almost indestructible mineral quartz.

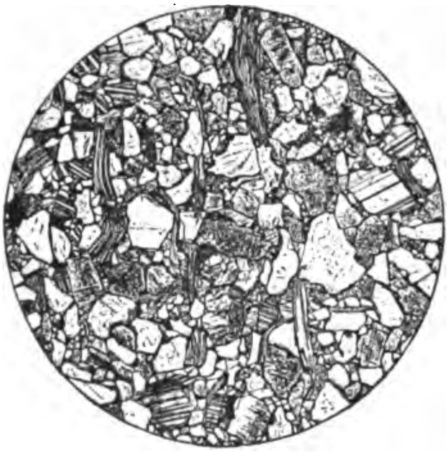

Fig. 92.
MICRO-STRUCTURE OF SANDSTONE.
(Portland, Connecticut.)

In structure the sandstones also vary greatly, in some the grains being rounded, while in others they are sharply angular. Fig. 92 shows the microscopic structure of a brown Triassic sandstone from Portland, Connecticut.

The material by which the individual grains of a sandstone are bound together is as a rule of a calcareous, ferruginous or siliceous nature; sometimes argillaceous. The substance has been deposited between the granules by percolating water and forms a natural cement. It frequently happens that the siliceous cement is deposited about the rounded grains of quartz in the form of a new crystalline growth converting the stone into quartzite; such are here classed with the crystaline rocks. (See p. 549.)

The colors of sandstone are dependent upon a variety of circumstances. The red, brown, and yellowish colors are due to iron oxides in the cementing constituent. In very light gray varieties the color is that of the minerals themselves composing the stone. Some of the dark colors are due to carbonaceous matter; others to iron protoxide carbonates or clayey matter. (See color series.)

Many varieties of sandstone are popularly recognized. Calcareous, ferruginous, siliceous, or argillaceous sandstones are those in which the cementing materials are of a calcareous, ferruginous, siliceous, or argillaceous nature. The name arkose is given to a coarse feldspathic sandstone derived frome granitic rocks. (Specimens No. 38135 from France and 39052 from Rhode Island.)

Conglomerate or puddingstone is merely a coarse sandstone; it differs from sandstone only as gravel differs from sand. (See specimens 25647 and 38199, which are but loosely consolidated gravels; also 38512, from Nantasket, Massachusetts.) The beautiful sample No. 70645 from Devonshire (?), England, is composed of rounded pebbles of jasper cemented by siliceous matter. In No. 28744, from near Point of Rocks, Maryland, is shown a Triassic conglomerate composed of both calcareous and siliceous pebbles, some of which are angular and some rounded, the rock thus presenting a form intermediate between conglomerates and the breccias. Sample No. 72795, from the Siskiyou Mountains, is perhaps rather a pebbly sandstone than a true conglomerate, being composed of large rounded pebbles in a finer grained or sandstone matrix.

Specimens 73080 and 73081, from Gallatin County, Montana, will illustrate the fragmental nature and origin of these rocks. Such were formed near the shore line of a now extinct lake, and show the irregular admixture of fine sand and rounded pebbles of quartz, feldspar, and other minerals, such as may not infrequently be seen on the margins of lakes and rivers of the present day.

Greywacke or Grauwacke is an old German name for brecciated fragmental rocks made up of argillaceous particles (Specimen No. 38156). The name is now little used. Other names, as flagstone, brownstone, and freestone, are applied to such of these rocks as are used for economic purposes, but which need not be referred to here. Shale is a somewhat loosely defined term, indicating structural rather than chemical or mineralogical peculiarities. The word is perhaps best used in its adjective sense, as a shaley sandstone or limestone. By many authors it is used with reference more particularly to thinly stratified or laminated clayey rocks (Specimen No. 36040). Itacolumite or flexible sandstone is a feldspathic quartzite from which the interstitial feldspathic portions have been removed by decomposition leaving the interlocking quartz grains with a small amount of play between them. The rock is in no sense elastic but merely loose jointed (Specimen No. 11951). (See also larger samples in special exhibit.)

Breccia is a fragmental rock differing from conglomerate in that the individual particles, having suffered but little attrition, are sharply angular instead of rounded. Specimen No. 37924, from the Yellowstone National Park, is a good type of these rocks. (See also Fig. 1, Plate CXIX.) No. 72794 is a chert breccia, the cementing material of which is sphalerite.

2. *The argillaceous group—Pelites.*—The rocks of this group are composed essentially of a hydrous silicate of alumina, which is the basis of common clay. In nature they are almost universally more or less impure through the presence of siliceous sand, calcareous or carbonaceous matter. They have originated in situ from the decomposition of feldspathic rocks or as deposits of fine mud or silt on the bottom of an ocean, or more rarely a lake or river. The older formations of argilla-

ceous rocks often display a pronounced fissile structure which is due as a rule to pressure, and in no way dependent upon the original bedding. Such, when splitting with sufficient ease into thin smooth slabs, are used for roofing and other purposes and known simply as slates. The cause of this slaty cleavage will be explained more fully under the head of dynamical geology. These cleavable rocks have been actually metamorphised by the pressure to which they have been subjected, and are therefore mainly exhibited with others of the metamorphic group. A few specimens are here placed to show the easy transitions from true fragmental rocks to the crystalline schists.

Kaolin is a very pure form of the hydrous silicate of alumina, formed from the decomposition of feldspathic rocks. It is, in its purest state, as has already been explained, a chemically formed rock, a residual product formed by the decay of feldspars and the removal of the soluble portions, the alkalies and iron oxides, by percolating water. It is used in the manufacture of porcelain ware. (Specimens 34441, 37240, 2879, 36029, etc.)

Kaolin, mixed with more or less siliceous matter, iron oxides, and other impurities, forms the well known common clay used by potters, pipe makers, for tile and for brick making. (Specimens 38162, 27394, 36783, 36042, 37278, 27407, etc.) The names clayey marl and shale are applied to indefinite admixtures of clay with calcareous and siliceous matters. Catlinite or "Indian pipe-stone" is an indurated clay rock formerly used by the Dakota Indians for pipe material. (Specimen 38373.) The name porcellainite has been given to a compact porcelain-like rock consisting of clay indurated by igneous agencies. (Specimens 36101 and 3809.) The name Wacke is sometimes used to designate an earthy or compact dark colored clayey rock resulting from the decomposition in situ of basaltic rocks. (See specimen No. 73102, with coating of hyalite, from Bohemia.)

3. *The calcareous group.*—Here are brought together a small series of fragmental rocks composed mainly of calcareous material, but of which the organic nature, if such it had, is not apparent. These rocks form at times beautifully brecciated marble. (See building and ornamental stone collection.) Their structure may be best comprehended by remembering that the original beds, whether crystalline or amorphous, whether fossiliferous or originating as chemical precipitates, have by geological agencies been crushed and shattered into a million fragments and then, by infiltration of lime and iron-bearing solutions been slowly cemented once more into solid rock. The actual amount of movement of the various particles has in many cases been but slight, as will be noted by reference to the collections. Specimen 72868 from the Sphinx, Montana, furnishes a good example of the coarser varieties of these rocks.

4. *The volcanic group—Tuffs.*—Here are brought together a great variety of fragmental rocks, composed of the more or less finely comm

nuted materials ejected from volcanoes as ashes, dust, and sand. Some of them, like the pumice dust from near Orleans, Nebraska (specimen No. 37023), are made up of minute shreds of pumiceous glass. These are the dust-like materials which, when blown from volcanic vents, are carried by atmospheric currents many miles and deposited so far from their original source that their true nature was never recognized until they came to be examined microscopically. (See under Æolian rocks.) Others, like the lapilli from the now extinct craters at Ice Spring Butte (specimen 35538), are irregular fragments of basaltic lava which when thrown into the air fell again into the immediate vicinity, forming beds of loose gravel and the cone of the crater itself. The character of the materials, therefore, varies almost indefinitely, and only very general names are given them in the majority of cases. The name tuff or tuffa is given to the entire group of volcanic materials formed in this way, and also by some authorities to fragmental rocks resulting from the breaking down and reconsolidation of older volcanic lavas. It would seem advisable to designate these last, as has F. Löwinson-Lessing,[*] as pseudotuffs or tuffoids. Characteristic forms of the tuffs are shown in the collections, and need not be especially enumerated here. The names volcanic ashes, sand, and dust are applied to the finer materials ejected and lapilli or rapilli to the coarser fragments like those from the extinct volcanoes of Ice Springs Butte, Utah (35538); Mono craters, California (29633); Pompeii and Monte Vultura, Italy (36603, 38794, and 38797). The finer dusts and sand, such as shown from Nebraska (37023 and 37024), Utah (37261), Montana (38584 and 38585), are of interest as being composed of minute shreds of volcanic glass which were blown from the volcanic vents and carried unknown distances to be ultimately deposited as stratified beds in comparatively shallow water. (See collections illustrating the transporting power of atmospheric currents.) The term trass is used to designate a compact or earthy fragmental rock composed of pumice dust, in which are imbedded fragments of trachytic and basaltic rock, carbonized wood, etc., and which occupies some of the valleys of the Eifel (specimen 36355 from Brohlthal, Prussia). Peperino is a tufaceous rock composed of fragments of basalt, leucite lava, and limestone, with abundant crystals of augite, mica, leucite, and magnetite. It occurs among the Alban Hills, near Rome, Italy. Palagonite tuff is composed of dust and fragments of basaltic lava with pieces of a pale yellow, green, reddish, or brownish glass called palagonite, as shown in specimens 36504 and 34739 from Nassau, Germany, or 36507 from Sicily. The general name of volcanic mud is given to such materials as that from Paterno, Sicily (73024).

The tuffs are as a rule more or less distinctly stratified, of very uneven texture, and with rarely a pisolitic structure as shown in the specimen from Nevada (35406) and Pompeii (73025). They are found associated with volcanic rocks of all ages and at times so highly metamorphosed as to render the original nature a matter of some doubt. In the series exhibited a large share are of Tertiary or post-Tertiary origin. Among the older and more altered forms attention may be called to those of Needham and Nantasket, Massachusetts (39050 and 38528); Scotland (70388), and Brazil (69977, 69980, and 69984).

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[*] Min. u. Pet. Mittheilungen, vol. 9, 1889, p. 530.

5. *Ferruginous group.*—This is a small and comparatively unimportant group, comprising only those fragmental rocks, the individual particles of which are composed mainly of ferruginous oxides. Such result from the breaking up of the iron ores, hematite and limonite, described under the head of rocks formed by chemical agencies.

### B.—ROCKS COMPOSED MAINLY OF DÉBRIS FROM PLANT AND ANIMAL LIFE.

1. *Siliceous group.*—Infusorial or diatomaceous earth. This is a fine white or pulverulent rock composed mainly of the minute shells, or tests, of diatoms, and often so soft and friable as to crumble readily between the thumb and fingers. It occurs in beds which, when compared with other rocks of the earth's crust, are of comparatively insignificant proportions, but which are nevertheless of considerable geological importance. Though deposits of this material are still forming,* and have been formed in times past at various periods of the earth's history, they appear most abundantly associated with rocks belonging to the Tertiary formations.

The celebrated Bohemian deposit is some 14 feet in thickness, and is estimated by Ehrenberg to contain 40,000,000 shell to every cubic inch. The Australian specimen exhibited (No. 28473) is from a deposit 4 feet in thickness. In the United States beds are known at Lake Umbagog, New Hampshire (specimen No. 29322); Morris County, New Jersey; near Richmond, Virginia (specimen No. 70689); Calvert and Charles Counties, Maryland (specimen 70689); in New Mexico; Graham County, Arizona (specimen No. 72912); Nevada (22346); California, and Oregon. The New Jersey deposit covers about 3 acres, and varies from 1 to 3 feet in thickness; the Richmond bed extends from Herring Bay, on the Chesapeake, to Petersburgh, Virginia, and is in some places 30 feet in thickness; the New Mexico deposit is some 6 feet in thickness and has been traced some 1,500 feet; Professor Leconte states that near Monterey, in California, is a bed some 50 feet in thickness, while the geologists of the Fortieth Parallel Survey report beds not less than 300 feet in thickness, of a pure white, pale buff or canary-yellow color as occurring near Hunter's Station, west of Reno, Nevada. (See specimen No. 22346.)

The earth is used mainly as a polishing powder, and is sometimes designated as *tripolite.* It has also been used to some extent to mix with nitroglycerine in the manufacture of dynamite. Chemically the rock is impure opal, as will be seen from the following analyses made on samples from (1), Lake Umbagog, (2), Morris County, New Jersey, and (3), Paper Creek, Maryland:

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* *E. g.*, in the marshes of the Yellowstone Park. See on the Diatom Marshes and Diatom Beds of the Yellowstone National Park, by W. H. Weed, Botanical Gazette, vol. XIV, No. 5, p. 117.

| | Per cent. | Per cent. | Per cent. |
|---|---|---|---|
| Silica | 80.53 | 80.60 | 81.53 |
| Iron oxides | 1.03 | ..... | 3.33 |
| Alumina | 5.89 | 3.84 | 3.43 |
| Lime | 0.35 | 0.58 | 2.61 |
| Water | 11.05 | 14.00 | 6.04 |
| Organic matter | 0.98 | ..... | ..... |

Number 3 showed also small amounts of potash and soda.

2. *Calcareous group.*—These rocks are made up of the more or less fragmental remains of mollusks, corals, and other marine and fresh-water animals. Many of them are but consolidated beds of calcareous mud full of more or less fragmentary shells or casts of shells as in specimen No. 70169 from near Cincinnati, Ohio, and No. 36139, from Rochester, New York. Others are composed wholly of quite perfect shells as the well known "coquina" from near St. Augustine, Florida, (specimen No. 26023. See Pl. CXXIII). From such forms as these we have all possible gradations to compact crystalline limestone. Such gradations may readily be traced among the specimens exhibited.

Special names are often given these calcareous rocks designating the character of materials from which they are derived. Coral and shell limestones, as the names denote, are composed mainly of the debris from these organisms (specimens 70169, 36139, 35907, 70036, 38591, 25197, and 35530). In the shell limestone (Lumachelle) from the Tyrol (No. 38783) the pearly lining of the shells still retains its original beauty. Shell marl is a loose, pulverulent earthy rock containing remains of shells (specimen No. 36043 from Drayton Island, Florida, and No. 70034 from Australia). Shell sand is a loose aggregate of shell fragments formed on sea beaches by the action of wind and waves (see specimen Nos. 20256 from Bermuda, and 35811 from the Hawaiian Islands). Crinoidal limestone is composed mainly of fragmental remains of crinoids (specimens Nos. 35791 from Onondago County, New York, and 35801 from the Isle of Gotland). Chalk is a fine white rock composed of finely broken shells of mollusks and other marine animals associated abundantly with the minute shells of foraminifera (specimen No. 36013 from England). Nummulitic limestone carries fossil nummulites as shown in the specimens from the pyramid of Cheops, Egypt (Nos. 39165 and 26816).

3. *Carbonaceous group.*—Peat, Lignite, Coals, etc. The rocks of this group are made up of the more or less fragmental remains of plants. In many of them, as the peats and lignites (specimens Nos. 70097 and 6962) the traces of plant structure are still apparent. In others, as the anthracite coals, these structures have become wholly obliterated by metamorphisms, or, if observable at all, are to be seen only with a microscope of high power. Such belong properly in the group of metamorphic rocks.

Plants when decomposing upon the surface of the ground give off their carbon to the atmosphere in the shape of carbonic acid gas, leaving only the strictly inorganic or mineral matter behind. When, however, protected from the oxidizing influence of the air by water, or other plant growth, decomposition is greatly retarded, a large portion of the carbonaceous and volatile matters are retained, and by this means, together with pressure from the overlying mass, the material becomes slowly converted into coal. According to the amount of change that has taken place in the carbonaceous matter, the amount of gaseous matter still contained by it, its hardness and burning qualities, several varieties are recognized.

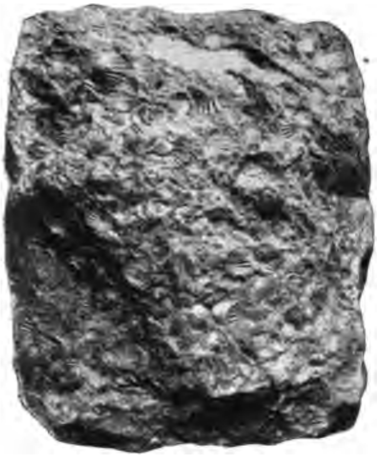
Peat is the matter in its least changed condition as it is found in bogs, and in which the plant remains are still plainly visible (specimens 70097 from New Hampshire, 36137 from Bavaria, and 59320 from Bering Island). Lignite is a form in which the woody structure is less apparent though often still recognizable as in specimen 6962 from France, and less distinctly in No. 35743 from the District of Columbia. Bituminous coal is a soft coal containing from 25 to 35 per cent. of volatile matter, and burning readily with a yellowish flame (specimens 36047, 36826, and 38224). Cannel coal is a variety of bituminous coal of a fine texture and almost no luster (specimen 59376). Anthracite is the hard, compact, highly lustrous metamorphic variety containing only traces of gaseous hydrocarbons, but with from 85 to 95 per cent. of carbon (specimen 36046). Graphite is pure crystallized carbon found in the older rocks and supposed by many to be of organic origin (specimen 36750).

4. *Phosphatic group.*—Phosphatic Sandstone; Bone breccia; Guano; Coprolite nodules. This is a group of rocks limited in extent, but nevertheless of considerable economic importance, owing to the high values of certain varieties for fertilizing purposes.

Guano consists mainly of the excrements of sea fowls, and is to be found in beds of any importance only in rainless regions like those of the western coast of South America and southern Africa (specimen 69281). The most noted deposits are on small islands off the coast of Peru. Immense flocks of sea fowls have, in the course of centuries, covered the ground with an accumulation of their droppings to a depth of sometimes 30 to 80 feet, or even more.

An analysis of American guano gave combustible organic matter and acids 11.3 per cent.; ammonia (carbonate, etc.) 31.7 per cent.; fixed alkaline salts, sulphates, phosphates, chlorides, etc., 8.1 per cent.; phosphates of lime and magnesia, 22.5 per cent.; oxalate of lime, 2.6 per cent.; sand and earthy matter, 1.6 per cent.; water, 22.2 per cent. (Geikie).

Coprolite nodules are likewise the excrements of vertebrate animals; those among the carboniferous shales of the basin of the Firth of Forth are regarded as accumulated excretions of ganoid fishes (specimen 36045).



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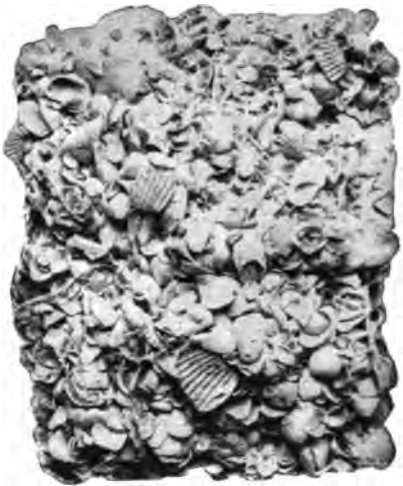

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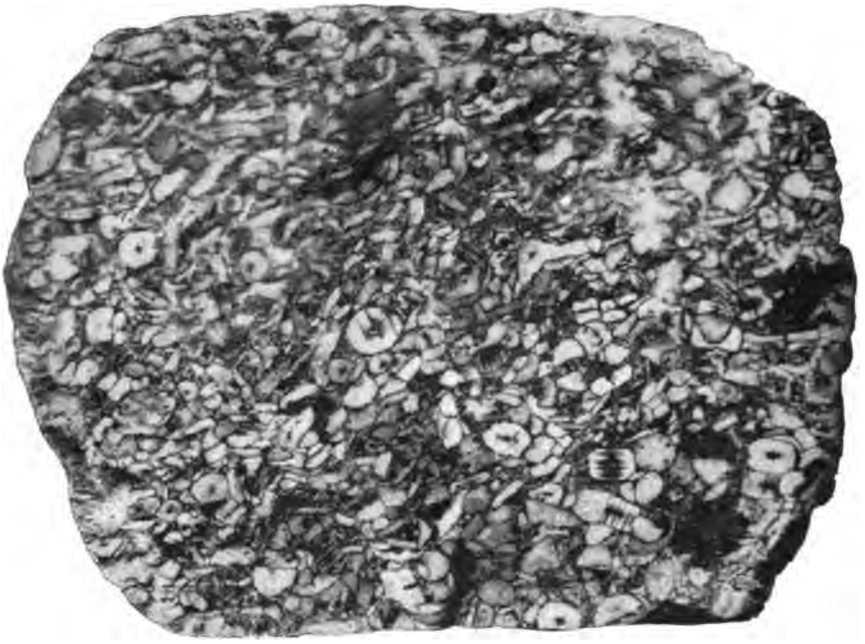

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FIGS. 1 and 2. Shell limestones. (Cat. Nos. 36139 and 26023, U. S. N. M.)
FIG. 3. Coral limestone. (Cat. No. 70036, U. S. N. M.)

Phosphatic sandstones, as the name indicates, are arenaceous rocks. Those from the Carolinas are dredged up in the form of rounded nodular masses from river bottoms, and consist of siliceous and calcareous sand with imbedded bones, fossil teeth of sharks, and other animal remains. These rocks are often of value as fertilizers, and a more complete display is to be found in the systematic collections of the South West Court.

Bone breccia consists mainly of fragmentary bones of living or extinct mammals. These are often cemented compactly by stalagmatic deposits.

### II—AEOLIAN ROCKS.

This group comprises a small and comparatively insignificant class of rocks formed from materials drifted by the winds, and more or less compacted into rock masses. They are, as a rule, of a loose and friable texture and of a fragmental nature. Many of the volcanic fragmental rocks (tuffs) are grouped here, their materials having been thrown from the volcanic vent in small fragments and drifted long distances by wind prior to falling upon the surface of the ground or into the water for their final consolidation.

The group will be more fully described under the head of processes of rock formation and the transporting power of atmospheric currents. The volcanic members of the series are represented by the fine pumiceous dust drifted from Iceland to the coast of Norway. (Specimen No. 35800); by the beautifully fine white dust from Orleans, Nebraska, (37023); Gallatin Valley, Montana, (38588); Lake Lahontan, California, (37208), and other sources in Montana, Colorado and Nevada.

In specimen No. 20255 we have an example of the fine calcareous sand formed on the beaches of Bermuda and drifted inland by the winds, often forming high hills or dunes which overwhelm vegetation and dwellings. Specimen No. 25197 shows the same sand consolidated by the solvent action of percolating water. (See collection illustrating the geology of Bermuda, and also the transporting power of atmospheric currents.)

### III—METAMORPHIC ROCKS.

Under this head is grouped a large series of rocks which have been changed from their original condition through dynamic and chemical agencies, and which may have been in part aqueous and in part of eruptive origin. Were it possible it would have been better to classify the rocks of this group under those of the other groups from which they were derived by this process of change, or metamorphism as it is called. In only too many cases, however, this change has been so complete as to quite obliterate all such traces of the original character as would lead to safe and satisfactory conclusions. In some instances it is nevertheless possible to trace the various stages of these changes through less and less altered forms to the original fragmental or eruptive rock. This is especially true with the calcareous rocks, and in the specimens exhibited such transitions are sometimes apparent. In the siliceous rocks these transitional forms are less readily traced. In specimen No. 36018, from Deer Isle, Maine, the conglomerate character of the rock is made apparent by the presence of pebbles, more or less changed and distorted, it is true, but still unmistakable indications of the former fragmental character of the beds. The finer grained portions, the material which formed the cementing or binding matter to hold the larger pebbles, yielded, as a matter of course, most readily to the metamorphosing influences, and gave rise to a fine aggregate of mica scales and other minerals, while the larger pebbles of quartz and feldspars offering greater resistance, have in some instances retained enough of their pebbly characteristics to still be recognizable. Accordingly as they vary in structure, we may divide these metamorphic rocks into two general groups, as below: A, stratified or bedded; B, foliated or schistose.

## A.—STRATIFIED OR BEDDED.

### The Crystalline Limestones and Dolomites.

*Mineral composition.*—The essential constituent of the crystalline limestones is the mineral calcite. The common accessories are minerals of the mica, amphibole, or pyroxene group, and frequently sphene, tourmaline, garnets, vesuvianite, apatite, pyrite, graphite, etc.

*Chemical composition.*—As may be inferred from the mineral composition these rocks, when pure, consist only of calcium carbonate. They are, however, rarely if ever found in a state of absolute purity, but show more or less magnesia, alumina and other constituents of the accessory minerals.

*Structure.*—The limestones are eminently straified rocks, though this peculiarity is not always sufficiently marked to be seen in the hand specimen. The purest and finest crystalline varieties often show a granular texture like that of loaf sugar, and hence are spoken of as saccharoidal limestones. Statuary marble is a good illustration of this type. (Specimen 17345, from Rutland, Vermont.) Under the microscope the stone is shown to be made up of small grains, which, having mutually interfered in process of growth, do not possess perfect crystal outlines, but are rounded and irregular in outline as shown in the transparency in the window (No. 39074) and in Fig. 93. All grades of texture are common, the coarser forms sometimes showing individual crystals an inch in length.

*Colors.*—The color of pure limestone is snow-white as seen in statuary marble. Other common colors are pink or reddish, greenish, blue, through all shades of gray to black. The pink and red colors are due to iron oxides, the greenish as a rule to micaceous minerals. (See color series.)

*Geological age and mode of occurrence.*—The limestones are metamorphosed chemical deposits or sedimentary beds occurring associated with rocks of all ages, from the earliest to the most recent. They are considered in large part as rocks composed of the metamorphosed débris of mollusks, corals, and other lime-secreting animals. In the process of metamorphism these remains may have been completely obliterated as in the Vermont marbles (specimen 17345), or may still be in part preserved though the entire mass has taken on a crystalline structure, as in numbers 35804, 35805, 35907, 69253, etc. To the paleontologist this group of rocks is one of very great importance, owing to their fossil remains. From an economic standpoint they are also of value, furnishing quantities of material for general building as well as beds of finest marble for ornamental work. (See building and ornamental stone collections.)

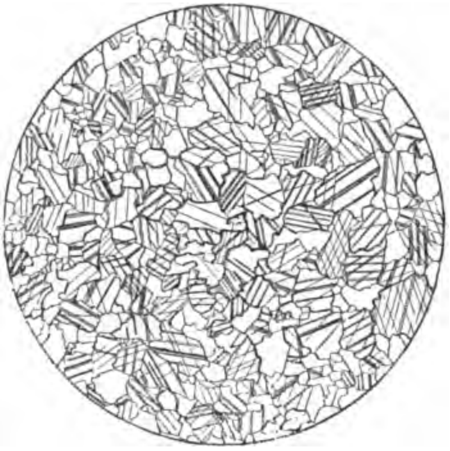


Fig. 93.

MICRO-STRUCTURE OF CRYSTALLINE LIMESTONE.

(West Rutland, Vermont.)

*Classification and nomenclature.*—It is common to speak of this entire group of rocks as simply limestones, though many varietal names are often rather indefinitely applied. The name *marble* is applied to any calcareous or magnesian rock sufficiently beautiful to be utilized in decorative work. *Argillaceous* and *siliceous* limestones carry clayey matter and sand. *Hydraulic limestones* contain varying proportions of magnesia, alumina, silica and iron oxides. Such furnish, when burned, a lime with the property of setting under water and known as hydraulic cement. (Specimens 39809 from Rosendale, Ulster County, New York.) *Dolomite* (so named after the French geologist Dolomieu) is a rock consisting of 45.50 per cent. carbonate of magnesia and 54.50 carbonate of lime. (Specimens 37662, 35906, 38820, 36854, 36729, etc.) In its typical form this is distinguishable from limestone by its greater hardness and by being less readily soluble in acids. In many cases chemical tests are rendered necessary to distinguish between them, and all gradations are common from limestone with a mere trace of magnesia to those which show the full amount characteristic of dolomite. The intermediate varieties are spoken of as magnesian or dolomitic limestones. (Specimens 37715, 70171, 26559, 26209, etc.) The snow-white coarsely crystalline rock from Pleasantville, West Chester County, New York (25046), and Lee, Massachusetts (37662), are good illustrations of dolomites. A chemical analysis of the Pleasantville dolomite as quoted in the circular of the Snowflake Marble Company yielded results as follows:

| | Per cent. |
|---|---|
| Carbonate of lime | 54.62 |
| Carbonate of magnesia | 45.04 |
| Carbonate of iron | 0.16 |
| Alumina | 0.07 |
| Silica | 0.10 |
| | 99.99 |

## B.—FOLIATED OR SCHISTOSE.

### 1. THE GNEISSES

Gneiss from the German *gneis*, a term used by the miners of Saxony to designate the country rock in which occur the ore deposits of the Erzgebirge (Teall). The word is pronounced as though spelled *nice* not *nees*.

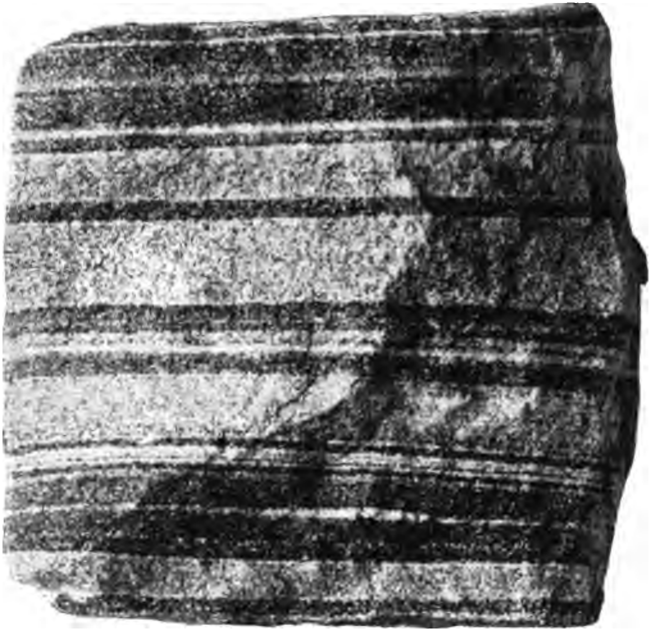
*Mineral and chemical composition.*—The composition of the gneisses is essentially the same as that of the granites from which they differ only in structure and origin. They, however, present a greater variety and abundance of accessory minerals, chief among which may be mentioned (besides those of the mica, hornblende or pyroxene group) garnet, tourmaline, beryl, sphene, apatite, zircon, cordierite, pyrite, and graphite.

*Structure.*—Structurally the gneisses are holo-crystalline granular rocks as are the granites, but differ in that the various constituents are arranged in approximately parallel bands or layers as in specimens 72862 and 72863, from Madison County, Montana, and 36180 from Brazil. In width and texture these bands vary indefinitely. It is common to find bands of coarsely crystalline quartz several inches in width, alternating with others of feldspar, or feldspar, quartz and mica or hornblende (see specimen 72862). A lenticular structure is common, produced by lens-shaped aggregates of quartz or feldspar, about and around which are bent the hornblendes or mica laminæ, as in specimen 26547 from Massachusetts, in the structural series. The rocks vary from finely and evenly fissile through all grades of coarseness and become at times so massive as to be indistinguishable from granites in the hand specimens. The causes of the foliated structure are mentioned below.

*Colors.*—Like the granites they are all shades of gray, greenish, pink or red.

*Geological age and mode of occurrence.*—The true gneisses are among the oldest crystalline rocks, and are considered by many geologists as representing "portions of the primeval crust of the globe, traces of the surface that first congealed upon the molten nucleus." By others they are regarded as metamorphosed sedimentary deposits resulting from breaking down of still older rocks, and may not in themselves therefore be confined to any one geological horizon. (See specimen conglomerate gneiss from Maine, No. 36018). They are in large part, however, indi-

PLATE CXXIV.



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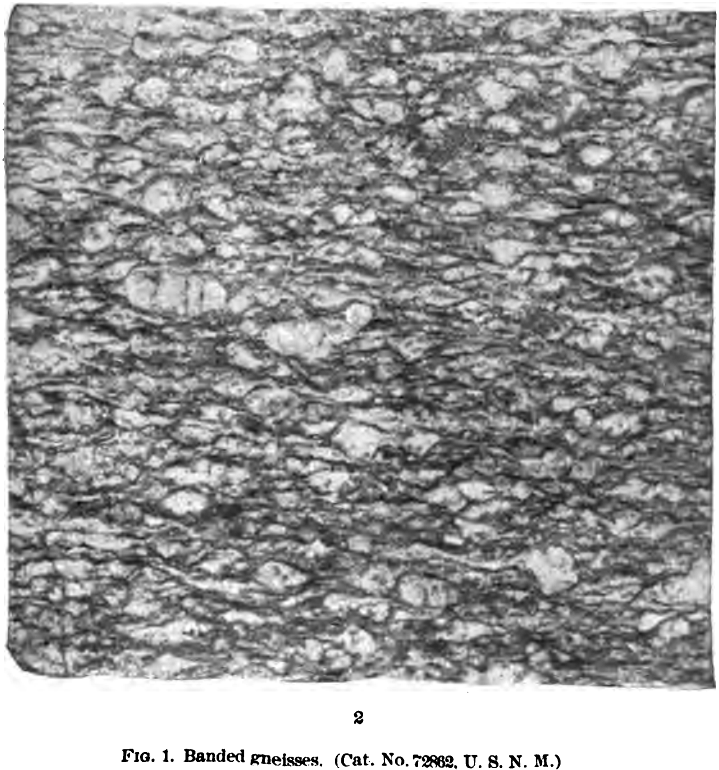

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FIG. 1. Banded gneisses. (Cat. No. 72862, U. S. N. M.)
FIG. 2. Foliated gneisses. (Cat. No. 26547, U. S. N. M.)

putably the oldest known rocks, lying beneath or being cut by all rocks of later formation or injection.

The origin of the gneisses as above suggested is in many cases somewhat obscure, the banded or foliated structure being considered by some as representing the original bedding of the sediments, the different bands representing layers of varying composition. In many schistose rocks this structure is now, however, considered to be due to mechanical uses, and in no way dependent upon original stratification (see Geikie's Textbook, pp. 123 and 298). The name as commonly used is made to include rocks of widely different structure, and which are beyond doubt in part sedimentary and in part eruptive, but in all cases altered from their original conditions. Figs. 1 and 2 on Pl. CXXIV show two rather extreme types of these rocks. Fig. 1 is that of a banded gneiss from Madison County, Montana (specimen 72862), and which, so far as we know, may be an altered sedimentary rock. In fig. 2 of the same plate (made from specimen No. 26547 in the building stone collection) is shown a foliated rather than a banded rock, and whatever may have been its origin it undoubtedly owes its foliated structure to dynamic agencies. The effect of the shearing force whereby the foliation was produced is evident in the figure, even to the unaided eye, to the left and just above the center, where an elongated feldspar is seen broken transversely into four pieces. The same features are shown even more plainly in fig. 94, which shows the structure of this same gneiss as seen under the microscope.

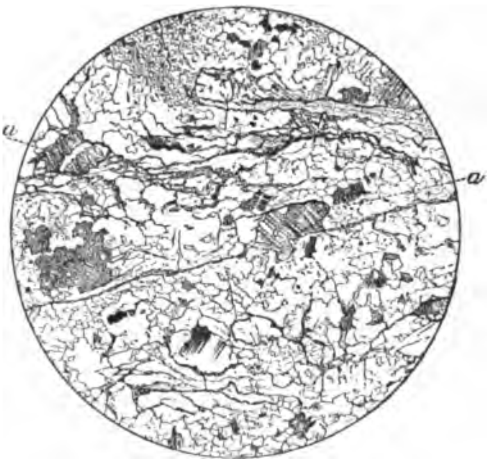

Fig. 94.

MICROSTRUCTURE OF GNEISS.

(West Andover, Massachusetts.)

(Drawn from section No. 26595. At *a a* are shown plagioclase crystals broken and rounded by the compressive force producing the foliation.)

As in the present state of our knowledge it is in most cases impossible to separate what may be true metamorphosed sedimentary rocks from those in which the foliated or banded structure is in no way connected with bedding and which may or may not be altered eruptives, all are grouped together here.

*Classification and nomenclature.*—The varietal distinctions are based upon the character of the prevailing accessory mineral as in the granites, forming a parallel series. We thus have *biotite-gneiss*, *muscovite-gneiss*, *biotite-muscovite-gneiss*, *hornblende-gneiss*, etc. Rarely the mineral cordierite occurs in sufficient abundance to become a characterizing accessory, as in specimens 73097 and 73178 from Saxony and Connecticut.

The term *syenite-gneiss* is used to designate a rock of the composition of syenite, but with a gneissoid structure. The name *granulite* is applied to a banded quartz-feldspar rock the constituents of which occur in the form of small grains and show under the microscope a mosaic structure. The Saxon granulites shown (specimens numbered 36126, 36658 to 36668, etc.) are regarded by Lehman as eruptive rocks altered by pressure. *Halleflinta* is a Swedish name for a rock resembling in most respects the eruptive felsites or quartz porphyries already described. Such, however, show a banded structure and are as a rule regarded as metamorphic rocks (see specimens 35673, 36676, 36677, and 38459 from Dannemora and Kopparberg, Sweden). *Porphyroid* is also a felsitic rock with a more or less schistose structure and with porphyritic feldspar or quartzes (specimens 36721, 36722, and 36723 from the Ardennes, France).

### 2. THE CRYSTALINE SCHISTS.

Under this head are grouped a large and extremely variable class of rocks differing from the gneisses mainly in the lack of feldspar as an essential constituent. They consist therefore essentially of granular quartz, with one or more minerals of the mica, chlorite, talc, amphibole, or pyroxene group. In accessory minerals the schists are particularly rich. The more common of these are feldspar, garnet (specimen 36112), cyanite, staurolite (specimen 36764), tourmaline (specimen 28574), epidote, rutile, magnetite, menacannite, and pyrite. Through an increase in the proportional amount of feldspar the schists pass into the gneisses and through a decrease in mica, hornblende, or whatever may be the characterizing mineral, into the quartz schists in which quartz alone is the essential constituent. Occasional forms are met with quite lacking in quartz and other accessory minerals and consisting only of schitose aggregates of minerals of a single species, as is the case with the pyrophyllite schists (or more properly schistose pyrophyllites) from North Carolina (specimen 27665), talcose schists from Michigan (specimen 35799) and St. Lawrence County, New York (specimen 36131), and with the more massive "soapstones" from Maryland (specimen 27331) and Vermont (specimen 25288).

The rocks of this group are characterized as a whole by a pronounced schistose structure, due to the parallel arrangement of the various constituents, this structure being most pronounced in those varieties in which mica is the predominating mineral. They are ordinarily considered as having originated from the crystallization of sediments, and in many cases the microscope still reveals existing "traces of the original grains of quartz sand and other sedimentary particles of which the rocks at first consisted." Like the gneisses they are in part, however, mechanically deformed massive rocks and their schistosity in no way relates to true bedding.

The varietal names given are dependent mainly upon the character of the prevailing ferro-magnesian silicate. We thus have *mica-schists*, *chlorite-schists*, *talc-shists*, *hornblende*, *actinolite*, *glaucophane schists*, etc. The term *slate* was originally applied to these and other types of rock of schistose or fissile-character. In the arrangement here adopted this term is restricted to the argillaceous fragmental or semi-crystalline and foliated rocks next to the described.

The first of the above mentioned varieties—the mica schists—are represented by some 40 specimens from widely separated localities, principally American and European, the mica being in some cases biotite, in others muscovite, or perhaps a mixture of the two. The principal accessories sufficiently developed to be conspicuous are staurolites (specimens 29358, 29359, 36764 and 36822); chiastolites (29361 and 36209); garnets (36122, 36881 and 36882); and tourmalines (28574). In the sericite schists the hydrous mica sericite prevails (specimens 36715, 36716, and 36718, from Germany); *Paragonite schist* carries the hydrous sodium-mica paragonite (specimen 36720, from St. Gotthard, Switzerland); *Ottrelite schist* carries the accessory mineral ottrelite (specimens 36724, from Ottrey, Belgium, and 37659, from Massachusetts).

The name *phyllite* is used by German petrographers to designate a micaceous semicrystalline rock standing intermediate between the true schists and clay slates. (Specimens 36697, 36699, 36701, 36704, and 36706, from various European localities.) *Quartzite* is a more or less schistose or banded rock consisting essentially of crystalline granules of quartz. Such originate from the induration of siliceous sandstones. This induration is brought about through a deposition of crystalline silica in the form of a binding material or cement around each of the sand particles of which the stone is composed. Each of these granules then forms the nucleus of a more or less perfectly outlined quartz crystal. This structure is shown in Fig. 95, drawn from a thin section of a Potsdam quartzite from St. Lawrence County, New York. The rounded more or less shaded portions represent the original grains of quartz sand, and the clear colorless interstitial portions the secondary silica.

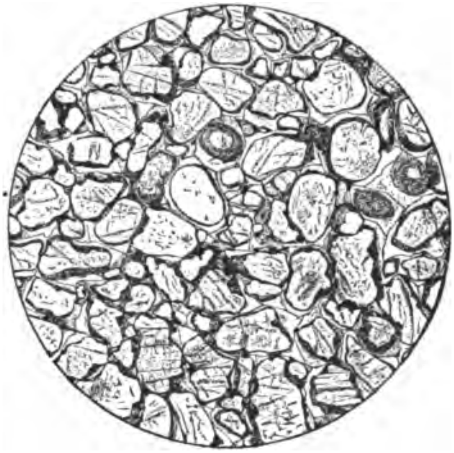

Fig. 95.

MICRO-STRUCTURE OF QUARTZITE.

(Potsdam, New York.)

The quartzites consist, as a rule, only of silica, or silica colored brown and red by iron oxides, as shown in specimens 37680, from Sioux Falls, Dakota, and 73078, from Madison County, Montana. At times a greenish tinge is imparted through the development of chloritic minerals (specimen 73079); accessory minerals are not, as a rule, abundant, and specimens like those from Clip, Arizona (72942), which are actually blue from the abundance of the mineral dumortierite, are quite exceptional. In specimens 70612 and 70613, from Pigeon Point, Minnesota, are shown quartzites somewhat altered by the action of intrusive rocks forced up through them. Specimens 70674, from McDowell County, North Carolina, carries abundant small indistinct garnets, and also white mica, giving it a schistose structure, and affording thus a form intermediate between the quartzites and mica schists.

Among the hornblende schists there are but few needing especial attention. It will be noticed that these are, as a rule, less finely schistose than are the mica-bearing schists, owing to the fact that the mineral hornblende is itself less finely fissile. The specimens from Woodbury, Connecticut (36121); Canaan, New Hampshire (29295); and Bavaria (36660) may be regarded as the more typical forms. No. 29300 from Hanover, New Hampshire, carries, it will be noticed, abundant small red garnets.

The *glaucophane schists* are perhaps the least abundant of the hornblendic varieties. They are represented in the collections by samples from the Isle of Syra in the Mediterranean (38626); Zermatt, Switzerland (70177); the Anglesey Monument, Wales, England (70421); Pegli, Riviera, Italy (73060) and the more massive form, perhaps an altered eruptive, from near the mouth of Sulphur Creek, Sonoma County, California (39103).

*Amphibolite* is the name given to an extremely tough and often massive rock of obscure origin, and consisting essentially of the mineral amphibole or hornblende. Specimens 37655, from Chester, Massachusetts; 36692 and 38220, from Ardennes and Isere, France; 36690 and 36691, from the Erzgebirge, and 36671 and 36672, from Saxony, may be considered as sufficiently typical, the last two as will be noticed carrying many garnets. In specimen 70408, from near Bamle, Norway, and 37437, from Maryland, the allied mineral anthophyllite takes the place of the ordinary hornblende. No. 38383, from Brandford, Massachusetts, and 70114, from Easton, Pennsylvania, differ from the ordinary amphibolite in that the varieties of amphibole *actinolite* and *tremolite* take the place of the common hornblende. The tremolite rock, it will be noticed, undergoes alteration into serpentine as shown by the adjoining specimen (70123).

*Eclogite* is a tough, massive or slightly schistose rock consisting of the grass-green variety of pyroxene omphacite and small red garnets, with which are frequently associated bluish kyanite, green hornblende (*smaragdite*), and white mica (See specimen 34670 and 35876) from Bavaria and California. *Garnet* rock or *garnetite* is a crystalline granular aggregate of garnets with black mica, hornblende, and magnetite (Specimen 36851, from North Carolina). *Kinzigkite* is a somewhat similar, though fine grained, and compact, rock consisting of garnets, plagioclase, feldspar, and black mica, and which is found in Kinzig and the Odenwald (specimen 36657).

### 3. THE ARGILLACEOUS SCHISTS. CLAY SLATES.

Clay slate, or roofing slate, differs from the argillaceous rocks already described (p. 537), in that it has undergone a certain amount of dynamic metamorphism which has developed in it its fissile character, and at the same time more or less obliterated its fragmental nature and converted it in many cases into an extremely fine-grained mica schist. The slates as a whole may perhaps be considered as standing intermediate between the true fragmental rocks and the crystalline schists, though a constant gradation is readily traced from the unaltered argillites through the cleavable slates to the so-called argillitic mica schists. The nature and structure of the rocks here included may be best understood by reference to Professor Geikie's text book, pp. 125 and 228. A more instructive series than is here shown is displayed in the exhibits devoted to dynamic geology.

## IV.—ROCKS FORMED THROUGH IGNEOUS AGENCIES. ERUPTIVE.*

This group includes all those rocks which having once been in a state of igneous fusion owe their present structural and other peculiarities to (1) The chemical composition of their original molten magmas, and (2) the conditions under which these magmas cooled. As a matter of general principle it may be stated that the greater the pressure under which a rock solidifies and the slower and more gradual the cooling the more perfect will be the crystalline structure. Hence it follows that the older and deep-seated rocks which were forced up in the form of dikes, bosses, or intrustive sheets into the overlying masses, and which have become exposed only through erosion, are the more highly crystalline, while those which like the modern lavas have flowed out upon the surface are more or less felsitic or glassy. (See Figs. 1, 2, 3, and 4, Pl. CXX. The rocks from which these sections were prepared are of essentially the same composition, the variations in structure being due to conditions of cooling.) Intermediate structures have been produced through a beginning of crystallization at certain depths below the surface, after which and while a portion of the magma was still fluid it was pushed upwards towards the surface where cooling progressed more rapidly, the result being a glassy or felsitic rock with scattering or porphyritic crystals, as shown in the structural series. It is customary to speak of this noncrystalline or unindividualized material as the groundmass or base. Rocks which are crystalline throughout are said to be *holocrystalline;* those which are without crystalline development, but consist of a structureless mass are *amorphous*. Intermediate varieties, in part crystalline and in part amorphous, those carrying crystals imbedded in a glassy or felsitic base, are called *hypocrystalline*.

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*Advantage has been taken of the opportunity here offered for bringing together as large a series as the present facilities will allow of such rocks as have been the subject of the close methods of scrutiny adopted in modern petrography. It therefore happens that certain groups, and perhaps the eruptive rocks as a whole, are represented in greater profusion than their geological importance seemingly warrants. The system of installation is, however, by no means inelastic, and when these other groups shall in their turn receive the attention they merit a place can readily be made for them by substitution, or, better yet, by an expansion of the entire series.

According to their mode of occurrence the eruptive rocks are divided here into two main groups. (1) The intrusive or plutonic rocks, and (2) the effusive, or volcanic rocks.[*] These two groups are then subdivided according to their mineral and chemical composition.

## A.—INTRUSIVE OR PLUTONIC ROCKS.

This group includes those rocks which, while in a molten condition, were forced up or intruded between the older and overlying rocks in the form of dikes, bosses, or intrusive sheets, and which never reached the surface, but cooled and crystallized at such depths and under such pressure as to become holocrystalline. They are found as a rule only among the older rocks, since it is only here that the erosion has been sufficient for their exposure. It is to be noticed that they are, as a rule, even to the unaided eye, distinctly crystalline; that they are never amygdaloidal or vesicular, and very rarely show flow structure; all of which are features common to the effusive rocks next to be described.

According to their mineral and chemical composition the rocks of this group are divided into nine subgroups, or families, as follows: (1) The granites, (2) the syenites, (3) the nepheline syenites, (4) the diorites, (5) the gabbros, (6) the diabases, (7) the theralites, (8) the peridotites, and (9) the pyroxenites.

### 1. THE GRANITES.

Granite, from the Latin *granum*, a grain in allusion to the granular structure.

*Mineral composition.*—The essential constituents of granite are quartz and a potash, feldspar (either orthoclase or microcline), and plagioclase. Nearly always one or more minerals of the mica, hornblende, or pyroxene group are present, and in small, usually microscopic forms, the accessories magnetite, apatite, and zircon; more rarely occur sphene, beryl, topaz, tourmaline, garnet, epidote, allanite, fluorite, and pyrite. Delesse[*] has made the following determination of the relative proportion of the various constituents in two well-known granites:

| Egyptian red granite. | Parts. | Porphyritic granite, Vosges. | Parts. |
|---|---|---|---|
| Red orthoclase | 43 | White orthoclase | 28 |
| White albite | 9 | Reddish oligoclase | 7 |
| Gray quartz | 44 | Gray quartz | 59 |
| Black mica | 4 | Mica | 6 |
| Total | 100 | Total | 100 |

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[*] Rosenbusch's group of dike rocks or gangesteine is here included with the plutonics.

[†] Prestwich Chemical and Physical Geology, vol. I, p. 42.

*Chemical composition.*—The average chemical composition as given by Geikie is as follows: Silica, 72.07; alumina, 14.81; potash, 5.11; soda, 2.79; lime, 1.63; magnesia, 0.33; iron protoxide, 2.22; loss by ignition, 1.09. Total, 100.05 per cent. Specific gravity, 2.66.

*Structure.*—The granites are holocrystalline granular rocks without trace of amorphous interstitial matter. As a rule none of the essential constituents show perfect crystal outlines, though the feldspathic minerals are often quite perfectly formed. The quartz has always been the last mineral to solidify, and hence occurs only as irregular granules occupying the interspaces. It is remarkable from its carrying innumerable cavities filled with liquid and gaseous carbonic acid or with saline matter. So minute are these cavities that it has been estimated by Sorby that from one to ten thousand millions could be contained in a single cubic inch of space. The microscopic structure of a mica granite from Maine is shown in transparency No. 39075 and in Fig. 1, Pl. CXX.

The rocks vary in texture almost indefinitely, presenting all gradations from fine evenly granular rocks to coarsely porphyritic forms in which the feldspars, which are the only constituents porphyritically developed, are several inches or feet in length. Compare specimens 36751 and 26815 from Maryland and Egypt, with 26386 and 38763 from Massachusetts and California. Concretionary forms are rare. Specimen No. 38546 (see Fig. 2, Pl. CXXVI) is of a granite concretion from Fonni, Sardina, cut in halves. Specimen 70098 from Craftsburg, Vermont, is unique on account of the numerous concretionary masses of black mica it carries.

*Colors.*—The prevailing color is some shade of gray, though greenish, yellowish, pink, to deep red, are not uncommon, as may be seen by reference to the collection. The various hues are due to the color of the prevailing feldspar and the abundance and kind of the accessory minerals. Granites, in which muscovite is the prevailing mica, are nearly always very light gray in color: (Specimen 36164 from the Vosges Mountains). The dark gray varieties are due largely to abundant black mica or hornblende (specimens 36186 and 38762 from Germany and California); the greenish and pink or red colors to the prevailing greenish, pink or red feldspars (specimens 29527, 26386, and 37667 from New Hampshire, Massachusetts, and New Brunswick).

*Classification and nomenclature.*—Several varieties are commonly recognized and designated by names dependent upon the predominating accessory mineral. We thus have (1) muscovite granite, (2) biotite granite or granitite, (3) biotite muscovite granite, (4) hornblende granite, (5) hornblende biotite granite, and more rarely (6) pyroxene, (7) tourmaline, and (8) epidote granite. The name *protogine* has been given to a granite in which the mica is in part or wholly replaced by talc (specimen No. 36127 from Mount Blanc). *Graphic granite* or pegmatite is a granitic rock consisting essentially of quartz and orthoclase so crystalized together in long parallel columns or shells that a cross section bears a crude resemblance to Hebrew writing (see specimens 10771, 3857, 69548, 4081, 35121, 39100, and 37927, and Fig. 4, Pl. CXXV. *Aplit* is a name used by the Germans for a granite very poor in mica and consisting essentially of quartz and feldspar only (specimen No. 36151 from Schemnitz, Hungary). The names *granitell* and *binary* granite have also been used to designate rocks of this class (specimen 25115 from Missouri). *Greisen* is a name applied to a quartz mica rock with accessory topaz occurring associated with the tin ores of Saxony and regarded as a granite metamorphosed by exhalations of fluoric acid (specimens 3364, 36165, and 36166). *Luxullianite* and *Trowlesworthite* are local names given to tourmaline or tourmaline-fluorite granitic rocks occurring at Luxullian and Trowlesworth, in Cornwall, England (specimens 36113 and 39002). The name *Unakite* has been given to an epidotic granite with pink feldspars and occurring in the Unaka Mountains in western North Carolina and eastern Tennessee (specimen 36784).

The name *granite porphyry* is made to include a class of rocks placed by Professor Rosenbusch under the head of "*gangesteine*," or dike rocks, and differing from the true granites mainly in structural features. They consist in their typical forms of orthoclase feldspars and quartzes porphyritically developed in a finer holocrystalline aggregate of the minerals common to the granite group. The characteristic features of the rocks so far as revealed by hand specimens may be best understood by referring to the collections (specimens 3873, 36219, 36220, and 36221, from Saxony, Germany, Silesia, and England).

The following localities and varieties are represented:

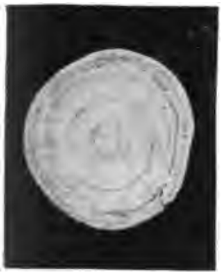
*Muscovite granite:* Hansdorf, Silesia, 36152; Schmenitz, Hungary, 36151; Raymond, Maine (with garnets), 12251; Barrington, New Hampshire, 29515.

*Pegmatite:* Auburn, Maine (polished slab), 39100; Minot, Maine (with tourmaline), 35966; Stowe, Maine, 10771; Portland, Connecticut, 35121; New Bedford, Massachusetts, 4081; Jefferson, Clear Creek County, Colorado, 69548; Limbach, near Penig, Saxony, 3857.

*Muscovite biotite granite:* Musquito Gulch, Park County, Colorado, 68813; Georgetown, Clear Creek County, Colorado, 36163; Musquito Gulch, Park County, Colorado, 36882; Canton Haag, in the Vosges Mountains, Germany, 36164; Vosges Mountains, Germany, 36156; Ochsenkopf, in the Fichtelgebirge, Germany, 36159; Gefrees, in the Fichtelbirge, Germany, 36157; The Erzgebirge, Germany, 36161; Greffenstein, Saxony, 36158; Isle of Elba, Italy, 36160; Mount Pleasant, Camborn, Cornwall, England, 36162.

*Biotite muscovite granite:* Manchester, Hillsborough County, New Hampshire, 3616[illegible]; Concord, Merrimack County, New Hampshire, 27081; Salem, New Hampshire, 27895; northwest from Crawford House, New Hampshire, 27868.

*Biotite granite:* Near Calais, Maine (pink), 70146; Auburn, Maine, 28539; Brunswick, Maine (with molybdenite) 28815; Millbridge, Washington County, Maine, 25[illegible]; Craftsburg, Vermont (orbicular granite), 70098; Lyme Station, New London, Connecticut, 26079; Baltimore, Maryland, 38355; Jones Falls, Baltimore, Maryland (with microline), 36751; Ilchester, Maryland (with allanite), 69550; Davidson College, Mecklenburgh County, North Carolina, 27644; Buckhorn Falls, Harnett County, North Carolina, 27653; Burnet, Texas, 38824; Buffalo, Jefferson County, Colorado, 36883; Iron Mass Mountains, Gunnison County, Colorado



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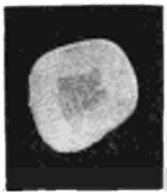

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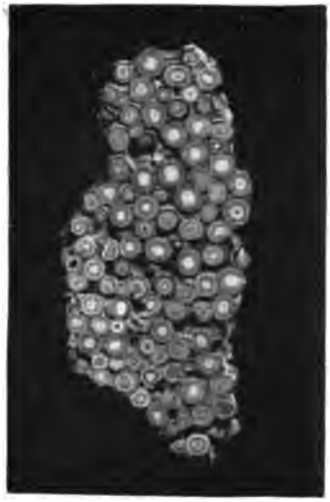

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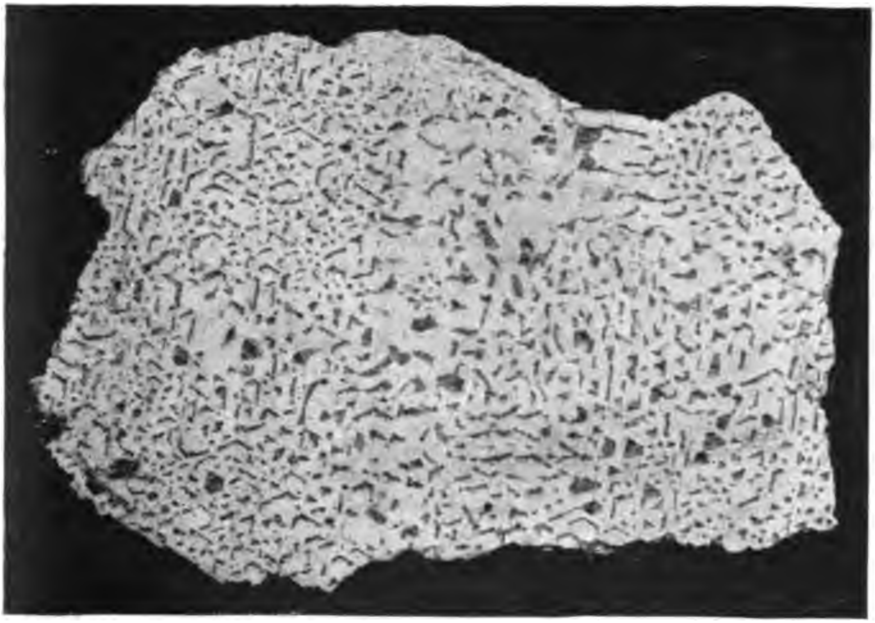

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FIGS. 1 and 2. Concretionary pebbles of siliceous sinter. (Cat. No. 12888, U. S. N. M.)
FIG. 3. Concretionary aragonite. (Cat. No. 36097, U. S. N. M.)
FIG. 4. Pegmatite. (Cat. No. 10771, U. S. N. M.)

28651. Gold Cañon, of Red Jacket Mine, Nevada, 24066. Between Los Angeles and Cocamonga, Los Angeles County, California, 38763; Peter-Head, Scotland, 36177; Korostyesor, South Russia (with garnets), 38816; Rhone, France, 38262; La Bresse Vosges, France, 38203; Roken, Christiania, Norway, 36178; Ockerthal, in the Harz Mountains, 36172; Brocken, in the Harz Mountains, 36171; Kirneckthal Barr, in the Vosges Mountains, Germany, 36170; Vosges Mountains, Germany, 36179; near Chemnitz, Saxony, 3854; near Bantzen, Saxony, 3852; Dresden, Saxony, 3850; Altenberg, Saxony, 3851; near Freiberg, Saxony, 3855 and 3853; near Pirna, Saxony, 3856; Kleesberg, Schneeberg, Saxony, 36180; Zeheen, Saxony, 36174; Aue, Schneeberg, Saxony, 36181; Silesia, 36168; Triberg, in the Black Forrest, Germany, 36169; Predazzo, Tyrol, 36167; Baveno, Lake Maggiore, Italy, 36176; Schrisheim, Baden, 36173; Japan, 11737.

*Hornblende biotite granite:* Meissen, Saxony, 36187; Reichenberg, Saxony, 36197; Markirch, Alsace, Germany, 36185; Kirneckthal, Vosges Mountains, Germany, 36184; Vosges Mountains, Germany, 36182; Hohwald, Vosges Mountains, Germany, 36183; Odenwald, Hesse, Germany, 36186; Loch Etive, Argyleshire, Scotland, 36191; Mount Sorrel, Leicestershire, England, 36189; Ilha de Pafueta Bay, Province de Rio Janeiro, Brazil, 69840; Alexandria, Egypt, 26815; Egypt, 70168; Lightning Mountain, Stratford, New Hampshire, 29527; Saw Pit Cañon, Los Angeles County, California, 38762; Buffalo Creek, Platte Cañon, Jefferson County, Colorado, 36192; near Salt Lake City, Utah, 39095.

*Hornblende granite:* Otter Creek, Mount Desert, Maine, 35923; Bemis Station, New Hampshire, 29524; Quincy, Massachusetts, 28556; Jimtown, Elysian Park, Colorado, 29264; top of Mount Lyell, California, 37201; St. George, New Brunswick, Canada, 37667; Groby, Leicestershire, England, 36196; Freiberg, Saxony, 3881; Elfdalen, Sweden, 36194; Upsala, Sweden, 36193; Meissen, Saxony, 3858; Romaniche, Saone et Loire, France, 38227; Haute Saone, France, 38260, 38263, and 36198; St. Maurice, Vosges Mountains, France, 36195.

*Augite granite:* Lavelline, Vosges Mountains, France, 38353.

*Tourmaline granite:* Heidelberg, Prussia, 70176; Luxullian, St. Austell, Cornwall, England (Luxullianite), 36113; Trowlesworth, England (Trowlesworthite), 39002; Govaranno, Tuscany, Italy, 38334; Predazzo, Tyrol, 39176.

*Greisen:* Zinwald, near Altenberg, Saxony, 3864 and 36165; Geyer, Saxony (with much topaz), 36166.

*Epidote granite:* Dedham, Norfolk County, Massachusetts, 36386; Milans Gap, Madison County, Virginia (Unakite), 36784.

*Biotite epidote granite:* Grand River, Colorado, 36027.

*Lithia granite:* Near Perus Station, Sao Paulo Railroad, Province de Sao Paulo, Brazil, 69819.

*Protogine:* Mount Blanc, 36127.

*Binary granite:* Middleboro, Missouri (without mica or hornblende), 25115.

*Granite porphyry:* Altenberg, Germany, 36219; near Freiberg, Saxony, 3973; Wheal Tremayne, Cornwall, England, 36221; Erdmansdorf, Silesia, 36220.

## 2. THE SYENITES.

The name Syenite, from Syene, a tower of Egypt.*

*Mineral composition.*—The syenites differ from the granites only in the absence of the mineral quartz, consisting essentially of orthoclase feldspar in combination with biotite, or one or more minerals of the amphibole or pyroxene group. A soda-lime feldspar is nearly always present and frequently microcline; other common accessories are apatite, zircon, and the iron ores.

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*The word syenite was first used by Pliny to designate the coarse red granite from quarries at Syene (see specimen 26185 in hornblende-biotite granite series), and used by the Egyptians in their obelisks and pyramids. Afterwards (in 1787) Werner introduced the word into geological nomenclature to designate a class of granu-

*Chemical composition.*—In column I below is given the composition of a hornblende syenite from near Dresden, Saxony, and in II that of a mica syenite (minette) from the Odenwald.

| | I. | II. |
|---|---|---|
| | *Per cent.* | *Per cent.* |
| Silica | 60.02 | 57.37 |
| Alumina | 16.66 | 13.84 |
| Ferric iron | 7.21 | 2.44 |
| Ferrous iron | | 3.44 |
| Magnesia | 2.51 | 6.65 |
| Lime | 3.59 | 5.53 |
| Soda | 2.41 | 1.53 |
| Potash | 6.50 | 4.47 |
| Ignition | 1.10 | 3.17 |

*Structure.*—The structure of the syenites is wholly analogous to that of the granites and need not be further described here. In process of crystallization the apatite, zircon, and iron ores were the first to separate out from the molten magma, and hence are found in more or less perfect forms inclosed by the feldspars and later formed minerals. These were followed in order by the mica, hornblende, or augite, and lastly the feldspars, the soda-lime feldspars, when such occur, forming subsequent to the orthoclase.

*Color.*—The prevailing colors, as shown by the collection, are various shades of gray, through pink to reddish.

*Classification and nomenclature.*—According as one or the other of the accessory minerals of the bisilicate group predominates we have (1) hornblende syenite, (2) mica syenite, or minette, and augite syenite.

Other varietal names have from time to time been given by various authors. The name *Minette*, first introduced into geological nomenclature by Voltz in 1828 (Teall), is applied to a fine-grained mica orthoclase rock, occurring only in the form of dikes and further differing from the typical syenites in having a porphyritic rather than granitic structure. (See specimens 36290 to 36299 inclusive, from Baden, Saxony, and various parts of Germany.) *Vogesite* (specimen 70025 from

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lar rocks consisting of feldspar and hornblende, either with or without quartz. Later, when a more precise classification became necessary, the German geologists reserved the name syenite to designate only the quartzless varieties of these rocks, while the quartz-bearing varieties were referred to the hornblendic granites. This is the classification now followed by all the leading petrologists and is therefore adopted here. Much confusion has arisen from the fact that the French geologist Roziere insisted upon designating the quartz-bearing rock as syenite, a practice which has been followed to a considerable extent both in this country and England.

Brazil) is the name applied to a similar rock in which hornblende or augite prevails in place of mica. These rocks are placed by Prof. Rosenbusch in his latest work in the group of syenitic lamprophyrs. *Monzonite* is a varietal name for the augite syenite of Monzoni in the Tyrol (specimens 36300 and 73112).

The distribution of the syenites is much more limited than is that of the granites. The following localities and varieties are now represented in the exhibition series:

*Hornblende syenite:* Marblehead Neck, Massachusetts, 35962; Red Hill, Moultonborough, New Hampshire, 29580; Blue Hills, Custer County, Colorado, 36881; Cluro Hills, Cortes Range, Nevada, 21288; Serra de Stinba, province of Bahia, Brazil, 69857 and 69858; Vosges Mountains, Germany, 36289; Biella, Piedmont, Italy, 36287; Oslö, Christiana, Norway, 36288; Ise, Japan, 11727; near Dresden, Moritzberg, Zischenwitz, and Meissen, Saxony, 3861, 3863, 36285 and 36286.

*Augite syenite:* Jackson, New Hampshire (Uralitic), 27909 and 29587; Monzoni, Tyrol (Monzonite), 36300 and 73112; Ilha do Cabo Frio, Rio de Janeiro, Brazil, 69934 and 69936; Serra do Hilario, province of Sao Paulo, Brazil (Vogesite), 70025.

*Mica syenite:* Schriesheim, Odenwald, Germany (Minette), 36293; Mittershausen, Odenwald, Germany, 36290; Nassau, Germany, 36296; Weinheim, Baden (Minette), 36291; Cleurz, in the Vosges Mountains, 36292; Spessburg, near Barr in the Vosges Mountains, 36225; Andlanthal, in the Vosges, 36294; Scharpenstein and St. Michaels, Saxony (Minette), 36297 and 36298; Schnappenhaussuer, in the Fitchtelgebirge (Lamprophyr of Gumbel), 36299; Gallatin and Jefferson Counties, Montana, 38600, 73168, and 73169.

*Syenite porphyry:* Near Altenberg, Saxony, 3871; St. Nabord, in the Vogesen, 73120.

### 3. THE NEPHELINE (ELÆOLITE) SYENITES. FOYAITS.

Nepheline from the Greek νεφελη, a cloud, since the mineral becomes cloudy on immersion in acid. Elæolite from ελαιον, oil, in allusion to its greasy luster. Syenite from Syene in Egypt.

*Mineral composition.*—The essential constituents of this group are nepheline (elæolite) and orthoclase, with nearly always a pyroxenic mineral and a plagioclase, feldspar. The common accessory minerals are sphene, sodalite, cancrinite, zircon, apatite, black mica, and the iron ores (ilmenite and magnetite) with occasional eucolite, melinophane (specimens 36339 and 36310), and also tourmalines, perowskite, and olivine. Calcite, epidote, chlorite, analcite, and sundry minerals of the zeolite group occur as secondary products.

*Chemical composition.*—The composition of the elæolite syenite from province of Algrave, Portugal, as given by A. Meriau, is as follows: Silica 54.61, alumina 22.07, sesquioxide of iron 2.33, protoxide of iron 2.50, magnesia 0.88, lime 2.51, soda 7.58, potash 5.46, water 1.13, titanic oxide 0.09, phosphoric acid 0.15 per cent.

*Color.*—The colors are light to dark gray and sometimes reddish.

*Structure.*—These, like the syenites and granites, are massive holocrystalline granular rocks, and as a rule sufficiently coarse in texture to allow a partial determination of the constituent parts by the unaided eye. In the Litchfield (Maine) syenite the elæolite often occurs in crystals upwards of 5 centimetres in length, and zircons 2 centimetres in length are not rare (specimens 26418 and 72884). Neither of the essential constituents occur in the form of perfect crystals, while the apatite, zircon, black mica, and pyroxenic constituents often present very perfect forms. The cancrinite occurs both as secondary after the elæolite and as a primary constituent in the form of long needle like yellow crystals with a hexagonal outline. This last form is especially characteristic of the Litchfield rock (see specimens Nos. 72884, 72885, and 72886). The sodalite occurs both as crystals and in irregular massive forms, coating the walls of crevices, as shown in specimens 36342, 38845, 72884 and 72885, from Maine, and from Ditro, Transylvania.

*Classification and nomenclature.*—Several varietal names have been given to the rocks of this group as described by various authors. *Miascite* was the name given by G. Rose to the syenite occurring at Miask in the Urals; *Ditroite* to that occurring at Ditro, in Transylvania (specimens 36342, 38813, 38814, 38815 and 73110), and *Foyaite* by Blum to that from Mount Foya in the province of Algrave in Portugal (specimens 34817 and 34820). The name *Zircon syenite* has been quite appropriately given to the variety from Laurvig (specimen No. 36341), in southern Norway, which is rich in this mineral. *Tinguaite* is the name proposed for a varietal form from Serra de Tingua, province of Rio Janeiro, Brazil (specimens 69953, 70234, 70235, 70236 and 70240.

Like the syenites proper, these are rocks of comparative rarity. The following varieties and localities are represented:

Near Hot Springs, Saline County, Arkansas, 27519 and 39188; Fourche Cove, Pulaski County, Arkansas, 4874 and 4885; Litchfield, Kennebec County, Maine, [illegible] and 35935; *Ibid*, with much cancrinite, 72884; *Ibid*, showing large patches of sodalite (blue) and cancrinite (yellow), together with zircons, 72885; Marblehead, Massachusetts, 37664; near Libertyville, New Jersey, 36776. Serra de Tingua, Brazil (Tinguaite), 69953, 70234, 70235, 70236, and 70240; Ilha do Cabo Frio, Rio Janeiro, Brazil, 69944; Aroen, Langsundsfjord, Norway (with eukolit and melinophane), 36340; *Ibid* (zirkon syenite), 36341; Little Aro, Barkevig and Laven, Aroen, Langsundsfjord, Norway, 70405, 36336, 36337, and 36338; Laurvik, Norway, 70400; Ditro, Transylvania (Ditroite), 38815 (with sodalite), 38813, 38814, 36342; Predazzo, Tyrol, 36340, 39184; Foya, Portugal (Foyaite), 34819 and 34820; Picota, Portugal, 34817.

Elæolite syenite porphyry (Liebnerite) near Predazzo, Tyrol, 36343; Viezena, F[illegible] Thal, Tyrol, 73113.

### 4.—The diorites (Greenstone in part).

Diorite, from the Greek word διωριζειν, to distinguish. Term first used by the mineralogist Hauy.

*Mineral composition.*—The essential constituents of diorite are plagioclase feldspar, either labradorite or oligoclase, and hornblende or black mica. The common accessories are magnetite, titanic iron, orthoclase, apatite, epidote, quartz, augite, black mica, and pyrite, more rarely garnets. Calcite and chlorite occur as alteration products.

*Chemical composition.*—According to Zirkel, the average chemical composition is silica, 52.66; alumina, 18.92; iron protoxide, 9.09; lime, 6.73; magnesia, 5.12; potash, 2.42; soda, 3.71; water, 1.35 per cent.

*Structure.*—Diorites are holocrystalline granular rocks, and are, as a rule, massive, though schistose forms occur. The individual crystals composing the rock are sometimes grouped in globular aggregates, thus forming the so-called *Orbicular diorite*, *Kugel diorite*, or Napoleonite, shown in specimen No. 6722 from Corsica (see also Pl. CXXVI). The texture is, as a rule, fine, compact, and homogeneous, and its true nature discernible only with the aid of a microscope; more rarely porphyritic forms occur.

*Colors.*—The colors vary from green and dark gray to almost black.

*Classification.*—Accordingly as they vary in mineral composition the diorites are classified as (1) diorite, in which hornblende alone is the predominating accessory; (2) mica diorite, in which black mica replaces the hornblende, and (3) augite diorite, in which the hornblende is partially replaced by augite. The presence of quartz gives rise to the varieties, *quartz*, *quartz augite*, and *quartz micadiorites*. The name *tonalite* has been given by Vom Rath to a quartz diorite containing the feldspar andesine and very rich in black mica (specimen 36361, from Monte Tonale, in the Tyrol). *Kersantite* is a dioritic rock occurring, so far as known, only in dikes, and consisting essentially of black mica and plagioclase, with accessory apatite and augite, or more rarely hornblende, quartz, and orthoclase (specimens 36356, 36357, 36360, 70206, 36358, 36359 and 39039). It differs from the true mica diorite in being, as a rule, of a porphyritic rather than granitic structure. Professor Rosenbusch, in his latest work, has placed the kersantites, together with the porphyritic diorites (Camptonites), under the head of dioritic lamprophyrs in the class of dike rocks or "gangesteine." The name, it should be stated, is from Kersanton, a small hamlet in the Brest Roads, department of Finistere, France.

The diorites were formerly, before their exact mineralogical nature was well understood, included with the diabases and melaphyrs under the general name greenstone (Ger. Grunstein). They are rocks of wide geographic distribution, but apparently less abundant in the United States than are the diabases. The lamprophyr varieties are still less abundant, so far as now known, and are represented in the collection, as will be noticed, by specimens from but five localities.

The following localities and varieties are at present represented:

*Diorites proper:* Near Reading, Berks County, Pennsylvania, 26474; Comstock Lede, Nevada, 24151, 24154, 24005, 24007, 24042; Agate Pass, Cortes Range, Nevada, 21312; Virginia Range, Washoe County, Nevada, 22616; Jamestown, Boulder County, Colorado, 26876; Howland, Lake County, Colorado, 68963; Buckskin Gulch, Park County, Colorado, 68967; Madison County, Montana, 73171, 73172, and 73173; Rio San Francisco, Brazil, 69870; Hesse, Germany, 36365; Redwitz, in the Fitchelgebirge, Bavaria, 36366; Weinheim and Schriesheim, Baden, 36367 and 3669; Frieberg, Saxony, 36368; La Fiesse, Vosges, France, 36372; Grisselham, Upland Sweden, 35635.

*Orbicular diorite*, kugel diorite, or napoleonite, Corsica, 67222, 36054 (polished slab).

*Mica diorite:* Stewartstown, New Hampshire, 27860; near Croton, New York, 72957; Comstock Lode, Nevada, 24124; Stony Point, Rockland County, New York, 38342; Lippinhof, near Freiberg, Black Forest, Baden, 38345.

*Quartz diorite:* Schwarzenberg, Saxony, 36362; Monte Tonale, in the Tyrol (tonalite), 36361; Mount Blanc, 3619; Schemenitz, Hungary, 26371; Neuntestein in the Vosges, 36363; Weinheim, Baden, 70207.

*Augite diorite:* Schemnitz, Hungary, 36373 and 36374; Cziclova Band, Hungary (with quartz), 70208.

Of the *dioritic*, lamprophyrs, are exhibited: *Camptonite*, Campton Falls, New Hampshire, 29424 and 29425; Livermore Falls, New Hampshire, 29452; North Lisbon, New Hampshire, 38042; Dixville Notch, New Hampshire, 29422; Forest of Dean Iron mines, Orange County, New York, 39399.

*Kersantite:* Kersanton, Finistere, France, 36356; Nassau, Germany, 36357 and 36360; Michælstein, Hartz Mountains, Germany, 70206; Wilischthal in the Erz-Gebirge, Saxony, 36358; Markish in the Vosges Mountains, 36359; Franklin Furnace, New Jersey, 39039.

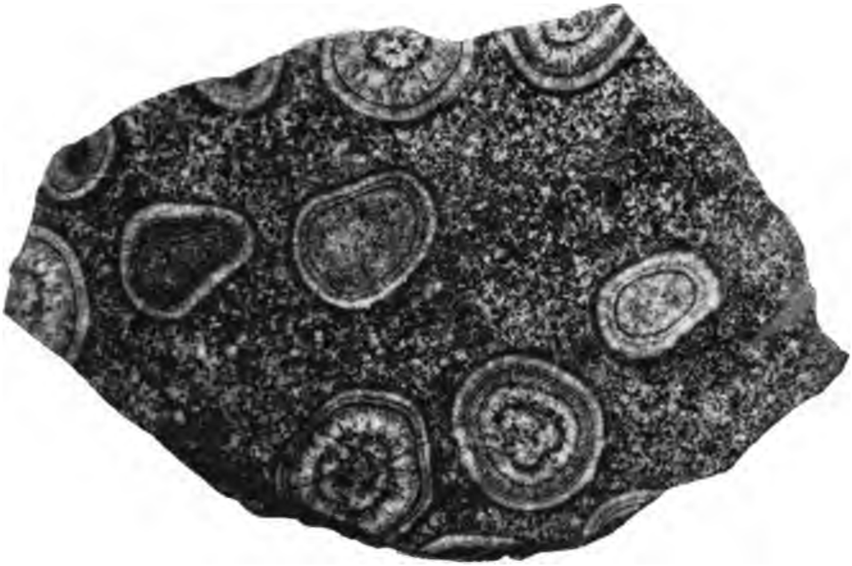
### 5. THE GABBROS.

Gabbro, an old Italian name originally applied to serpentinous rocks containing diallage.

*Mineral composition.*—The gabbros consist essentially of a basic soda lime feldspar, either labradorite, bytownite or anorthite, and dillage or a closely related monoclinic pyroxene, a rhombic pyroxene (enstatite or hypersthene), and more rarely olivine. Apatite and the iron ores are almost universally present and often picotite, chromite, pyrrhotite, more rarely common pyrites, and a green spinell. Secondary brown mica and hornblende are common. Quartz occurs but rarely.

*Chemical composition.*—The average of seven analyses as given by Professor Zirkel is as follows: Silica 50.17, alumina 16.39, oxide of iron 11.91, lime 9.49, magnesia 6.06, potash .93, soda 2.67, ignition 1.84 per cent. Specific gravity, 2.85 to 3.10.

*Structure.*—The gabbro structure is quite variable. Like the other plutonic rocks mentioned they are crystalline granular, the essential constituents rarely showing perfect crystal outlines. As a rule the pyroxenic constituent occurs in broad and very irregularly outlined plates, filling the interstices of the feldspars which are themselves in short and stout forms quite at variance with the elongated lath-shaped forms seen in diabases. This rule is, however, in some cases reversed, and the feldspars occur in broad irregular forms surrounding the more perfectly formed pyroxenes. (See very coarse gabbro from Monte Ferrato, near Prato, Italy, No. 73056.) Transitions into diabase structure are not uncommon. In rare instances the pyroxenic constituents occur in concretionary aggregates or kugels as in the peculiar gabbro from Smaalanene in Norway (see large specimen No. 38429). Through a molecular change of the pyroxenic constitutent the gabbros pass into diorites as do also the diabases. A beautiful illustration of this is given in the gabbro about Baltimore, Maryland, described by Dr. George H. Williams, and represented in the collections by specimens 36754 and 36755. Both are from the same rock mass, but one is a typical gabbro while the other would be classed as a diorite if judged by its mineral composition alone.



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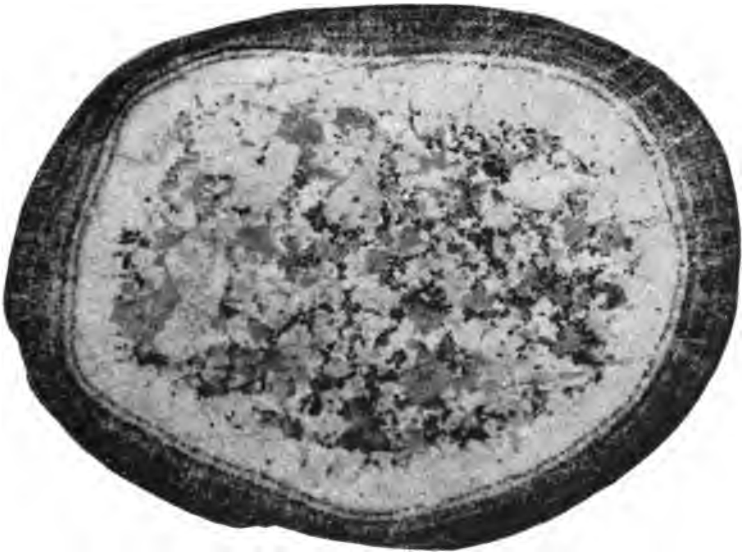

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FIG. 1. Orbicular diorite. (Cat. No. 36054, U. S. N. M.)
FIG. 2. Granite spheroid. (Cat. No. 38596, U. S. N. M.)

*Colors.*—The prevailing colors are gray to nearly black; sometimes greenish through decomposition.

*Classification.*—The rocks of this group are divided into (1) the true gabbros—that is, plagioclase diallage rocks—and (2) norites or plagioclase bronzite and hypersthene rocks. Both varieties are further subdivided according to the presence or absence of olivine. We then have:

True gabbro = Plagioclase + diallage.
Olivine gabbro = Plagioclase + diallage and olivine.
Norite = Plagioclase + hypersthene or bronzite.
Olivine norte = Plagioclase + hypersthene and olivine.

Nearly all gabbros contain more or less rhombic pyroxene, and hence pass by gradual transitions into the norites. (Illustrated in specimens 38429, 39016 and 36754.) Through a diminution in the proportion of feldspar they pass into the peridotites, and a like diminution in the proportion of pyroxene gives rise to the so-called *forellenstein.* (Specimens 36522 and 36523, from Volpersdorf, Silesia.) *Hyperite* is the name given by Tornebohm to a rock intermediate between normal gabbro and norite. (Specimen 70416, from Norway.)

The following are the principal localities and varieties now represented:

*Gabbro:* Gilford and Waterville, New Hampshire, 37048, 37047, and 27856; Beaver Bay, Lake County, Minnesota, 26571 and 26632; Washingtonville, Orange County, New York, 36129; Coverack, Lizard District, England (the diallage rock of De la Beche), 39003; Bamle, Norway, 70410; Volpersdorf, Silesia, 36510 to 36514 inclusive; Schmalenberg, Prussia, 36515 and 36516; Monte Ferrato, near Prato, Italy, 73056; near Porretta, Province of Bologne, Italy, 36517, 36518, and 73059; Monte Cavaloro, Bologne, Italy (oligoklasit), 36519 and 73058; Kijor, South Russia, 38,809.

*Olivine gabbro:* Pigeon Point, Minnesota, 70611; Pikesville, Maryland, 69556; Gwynn's Falls, Maryland, 36753; Volpersdorf, Silesia, 36520 to 36523, inclusive; Elfdalen, Sweden, 36524; Snarum, Norway, 36525; Bamle, Norway, 36526; Anson, North Carolina, 39016; Ilchester, Maryland, 69552; near Baltimore, Maryland, 36754 and 36755; the last a gabbro diorite resulting from the molecular alteration of the gabbro No. 36754, both samples being broken from the same rock mass.

*Norite:* Keeseville, Essex County, New York, 38744, 38748, and 29346, the last with garnets; Port Kent, New York (hyperite), 36125; Kragero, Norway (hyperite), 70416; Ebersdorf, Saxony (hypersthenite), 34680; Radanthal, Harz Mountains, Germany (hypersthenite and bronzite anorthite rock), 36527 and 73045; Barro do Pratorio, Rio Tubaras, Province of Sta. Catharina, Brazil (olivine norite), 69876; Baste Harz (bastite), 36528.

*Hypersthene gabbro:* West side of Ramsas Mountain, about 35 kilos southeast of Christiana, Norway. (Large mass on special pedestal, 38429). This rock is a peculiar variety of gabbro and has been called "Potato Rock" on account of its fancied resemblance to a mass of potatoes imbedded in a matrix. It consists, according to Prof. Meinich, of "kugels,' or concretionary nodules of greenish-brown labradorite, greenish oligoclase, scales of brown and green mica, and abundant magnetite. It occurs associated with the nickel ores of Smalenene.

### 6. THE DIABASES.

Diabase, from the Greek word διαβασις, a passing over; so called by Brongniart because the rock passes by insensible gradations into diorite.

*Mineral composition.*—The essential constituents of diabase are plagioclase feldspar and augite, with nearly always magnetite and apatite in microscopic proportions. The common accessories are hornblende, black mica, olivine, enstatite, hypersthene, orthoclase, quartz, and titanic iron. Calcite, chlorite, hornblende, and serpentine are common as products of alteration. Through a molecular change known as uralitization the augite not infrequently becomes converted into hornblende, as already described (page 516), and the rock thus passes over into diorite. The plagioclase may be labradorite, oligoclase, or anorthite.

*Chemical composition.*—The average chemical composition as given by Zirkel is as follows: Silica, 49.54; alumina, 15.50; iron protoxide, 14.27; lime, 8.20; magnesia, 5.29; potash, 1.16; soda, 3.38; loss by ignition 2.29 per cent. Specific gravity, 2.8.

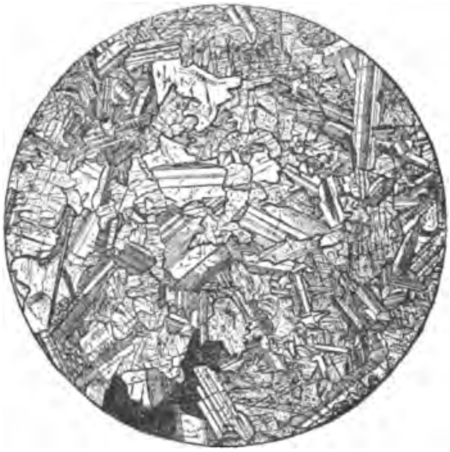

Fig. 96.
MICRO-STRUCTURE OF DIABASE.
(Weehawken, New Jersey.)

*Structure.*—In structure these rocks are holo-crystalline granular, very rarely showing any trace of amorphous or glassy base.* Rarely do the constituents possess perfect crystal outlines, but are more or less imperfect and distorted, owing to mutual interference in process of formation, the granular hypidiomorphic structure of Prof. Rosenbusch. The augite in the typical forms occurs in broad and sharply angular plates inclosing the elongated or lath-shaped crystal of plagioclase, giving rise to a structure known as ophitic (see Fig. 96). The rocks are, as a rule, compact, fine, and homogeneous, though sometimes porphyritic and rarely amygdaloidal.

*Colors.*—The colors are somber, varying from greenish through dark-gray to nearly black, the green color being due to a disseminated chloritic or serpentinous product resulting from the alteration of the augite or olivine.

*Classification.*—Two principal varieties are recognized, the distinction being based upon the presence or absence of the mineral olivine. We thus have: (1) Olivine diabase, or diabase containing olivine, and (2) diabase proper, or diabase without olivine.

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* Iddings discovered the presence of a glass base in the diabase of Orange Mountain, New Jersey. American Journal of Science, May, 1888.

Many varietal names have been given from time to time by different authors. Gumbel gave the name of *leucophyr* to a very chloritic diabase-like rock consisting of pale green augite and a saussurite-like plagioclase. (Specimens 36439 and 36440, from Bavaria and the Vosges.) The same authority gave the name *epidiorite* to an altered diabase rock occurring in small dikes between the Cambrian and Silurian formations in the Fichtelgebirge, and in which the augite had become changed to hornblende. (Specimens 36370 and 70209, from Champ St. Veron, Belgium.) He also designated by the term *proterobase* a Silurian diabase consisting of a green or brown somewhat fibrous hornblende, reddish augite, two varieties of plagioclase, chlorite, ilmenite, a little magnetite, and usually a magnesian mica. (Specimens 36435 to 36438, inclusive, from Bavaria, Saxony, and the Vogesen.) The name *ophite* has been used by Pallarson to designate an augite plagioclase eruptive rock rich in hornblende and epidote and occurring in the Pyrenees. The researches of M.Levy Kuhn (Untersuchungen über pyrenäische Ophite, Inaug. Dissertation) and others have, however, shown that both these constituents are secondary, resulting from the augite alteration and that the rock must be regarded as belonging to the diabases. (Specimens 36477 to 36480, from France.)

The Swedish geologist Törnebohm gave the name *sahlite diabase* to a class of diabasic rocks containing the pyroxene sahlite, and which occurred in dykes cutting the granite, gneiss, and Cambrian sandstones in the province of Smaaland and in other localities. (Specimen 36441, from Scotland). The name *teschenite* was for many years applied to a class of rocks occurring in Moravia, and which, until the recent researches of Rohrbach, were supposed to contain nepheline, but are now regarded as merely varietal forms of diabase. (Specimens 36529, 36530, 36531, and 36533.) *Variolite* is a compact often spherulitic variety occurring in some instances as marginal facies of ordinary diabase. (Specimens 73124 and 73125, from the headwaters of the Durance, on the Franco-Italian frontier.) The name *eukrite* or *eucrite* was first used by G. Rose to designate a rock consisting of white anorthite and grayish green augite occurring in the form of a dike cutting the carboniferous limestone of.Carlingford district, Ireland. These rocks were included by Prof. Zirkell under the head of "anorthitgesteine." The name is now little used, and rocks of this type are here included with the diabases. (Specimens 35736 and 34828, from Finmark, Norway.)

The diabases are among the most abundant and widespread of our so-called trap rocks occurring in the form of dikes, intrusive sheets and bosses. They are especially characteristic of the Triassic formations of the Eastern United States.

The following are the principal varieties and localities now represented:

*Diabase:* Near Calais, Maine, 70147; Waterville, New Hampshire (mica diabase), 27879; Ossipee, New Hampshire (labradorite porphyry), 27853; Medford, Massachusetts, 26423; Hingham, Massachusetts, 38377; Greenfield, Massachusetts, 38385; Rocky Hill, Somerset County, New Jersey, 26843; York County, Pennsylvania, 37020; Goose Creek, Loudoun County, Red House, Charlotte County, and Brandy Station, Culpeper County, Virginia, 28116, 73208, and 73215; Lookville, North Carolina, 73210; Forder Saltash, Cornwall, England, 39007; Gove Saltash, Cornwall, England, 39008; Craig Park, Glasgow, Scotland, 70382 and 70384; Magdesprung, Wolfshagen, Bodenthal, Blankenburg, Altenbrak, etc., Hartz Mountains, Germany, 36426, 36427, 36428, 36429, 36430, 36431; Nassau, Germany, 36420, 36422. 36424, and 36425; Anhalt, Germany, 36432; Ehrenbreitstein, Prussia, 36419; Nahe, Prussia, 36418, and 36426; Steinbach and Berneck, in the Fichtel Gebirge, 36433 and 36434; Boguschowitz, Moravia (teschenite), 36529 to 36531 inclusive, and 36533; Koditz, in the Fichtel Gebirge (leukophyr), 36439; Breitenbach, in the Voges Mountains, 36440; Hartz Mountains (ophite), 6723; Haute Goronne, France (ophite), 36477 and 36478; Beziers, Heranet, France (ophite), 36479; Garraux, Pyrences, France (ophite), 36480; Champ St. Veron, Brabant, Belgium (Epidiorite), 36370 and 70209; Edinburgh, Scotland (sahlitdiabase), 36441; Hof, in the Fichtel Gebirge (proterobase), 36435; Bautzen, Saxony (proterobase), 36436 and 36437; Sperberbach, Hohwald, in the Vosges Mountains (proterobase), 36438. Hammerfest, Province of Finmark, Norway (Eukrite), 34828 and 35736.

*Olivine diabase:* Addison, Washington County, Maine, 37019 and 36843; Tenant's Harbor, Knox County, Maine, 39043; Auburn, Maine, 28533; Lewiston, Maine (very rich in olivine), 37618; near Mine La Motte Station, Missouri, 70129; Thetford Hill, Vermont (drift), 35062; Rio Janeiro, Brazil, 69904.

### 7. THE THERALITES.

Theralite from the Greek word *θηραν*, to seek eagerly.

This is the name given by Professor Rosenbusch to a class of intrusive rocks consisting essentially of plagioclase feldspar and nepheline, and which are apparently the plutonic equivalents of the tephrites and basanites. Rocks of this group are, so far as now known, of very limited distribution.

The group is founded by Professor Rosenbusch upon certain rocks occurring in dikes and laccolites in the Cretaceous sandstones of the Crazy Mountains of Montana, and described by Prof. J. E. Wolff,[*] of Harvard University.

*Mineral composition.*—The essential constituents as above noted are nepheline and plagioclase with accessory augite, olivine, sodalite, biotite, magnetite, apatite and secondary hornblende, and zeolitic minerals.

*Chemical composition.*—The chemical composition as given by Mr. Wolff of a sample from near Martinsdale is as follows: Silica, 43.175; alumina, 15.236; ferrous oxide, 7.607; ferric oxide, 2.668; lime, 10.633; magnesia, 5.810; potash, 4.070; soda, 5.68; water, 3.571; sulphuric anhydride, 0.94 per cent.

*Structure.*—The rocks are holocrystalline granular throughout.

*Colors.*—These are dark gray to nearly black.

The theralites so far as known have an extremely limited distribution. The group is represented in the collection only by samples from Gordon's Butte, and Upper Shields River basin in the Crazy Mountains, Montana, 70599 and 73138; and Jaguecy, Xirinca, Rio Riberia, Province of Sao Paulo, Brazil, 70023.

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[*] Notes on the Petrography of the Crazy Mountains and other localities in Montana, by J. E. Wolff. Also Neues Jahrb., 1885, I, p. 69.

### 8. The peridotites.

Peridotite, so called because the mineral peridot (olivine) is the chief constituent.

*Mineral composition.*—The essential constituent is olivine associated nearly always with chromite or picotite and the iron ores. The common accessories are one or more of the ferro-magnesian silicate minerals augite, hornblende, enstatite and black mica; feldspar is also present in certain varieties and more rarely apatite, garnet, sillimanite, perowskite and pyrite.

*Chemical composition.*—The chemical composition varies somewhat with the character and abundance of the prevailing accessory. The following table shows the composition of several typical varieties:

| | I. | II. | III. | IV. | V. | VI. |
|---|---|---|---|---|---|---|
| Silica | 41.58 | 43.84 | 39.103 | 42.94 | 38.01 | 45.08 |
| Alumina | 0.14 | 1.14 | 4.94 | 10.87 | 5.32 | 6.28 |
| Magnesia | 49.28 | 44.33 | 29.176 | 16.32 | 23.29 | 34.76 |
| Lime | 0.11 | 1.71 | 3.951 | 9.07 | 4.11 | 2.15 |
| Iron sesquioxide | | 8.76 | 4.315 | 3.47 | 6.70 | 9.12 |
| Iron protoxide | 7.49 | | 11.441 | 10.14 | 4.92 | |
| Chrome oxide | | 0.42 | 0.446 | | | 0.26 |
| Manganese | | 0.12 | 0.276 | Trace. | | |
| Potash | | | Trace. | 0.15 | 0.22 | |
| Soda | | | | 0.90 | 4.15 | |
| Nickel oxide | 0.34 | | | | | |
| Water and ignition | 1.72 | 1.06 | 5.669 | 6.09 | 10.60 | 1.21 |
| Specific gravity | | 3.287 | 2.93 | 2.88 | 2.83 | 3.269 |

(I) Dunite: Macon county, North Carolina. (II) Saxonite: St. Paul's Rocks, Atlantic Ocean. (III) Picrite: Nassau, Germany. (IV) Hornblende Picrite: Ty Cross, Anglesia. (V) Picrite: Little Deer Isle, Maine. (VI) Lherzolite: Monte Rossi, Piedmont.

*Structure.*—The structure as displayed in the different varieties is somewhat variable. In the dunite it is as a rule even crystalline granular, none of the olivines showing perfect crystal outlines. (Specimen 36845 from North Carolina.) In the picrites the augite or hornblende often occurs in the form of broad plates occupying the interstices of the olivines and wholly or partially inclosing them, as in the hornblende picrite of Stony Point, New York, No. 38339. The saxonites and lherzolites often show a marked porphyritic structure produced by the development of large pyroxene crystals in the fine and evenly granular ground mass of olivines. (Specimen 35758 from Norway. See also Fig. 97, as drawn by Dr. G. H. Williams.) The rocks belong to the class designated as hypidiomorphic granular by Professor Rosenbusch, that is rocks composed only in part of minerals showing crystal faces peculiar to their species.

*Colors.*—The prevailing colors are green, greenish-gray, yellowish-green, dark green to black.

*Nomenclature and classification.*—Mineralogically and geologically it will be observed the peridotites bear a close resemblance to the olivine diabases and gabbros, from which they differ only in the absence of feldspars. Indeed, Prof. Judd has shown that the gabbros and diabase both in places pass by insensible gradations into peridotites through a gradual diminution in the amount of their feldspathic constituents. Dr. Wadsworth would extend the term peridotite to include rocks of the same composition, but of meteoric as well as terrestrial origin, the condition of the included iron, whether metallic or as an oxide being considered by him as nonessential, since native iron is also found occasionally in terrestrial rocks, as the Greenland basalts and some diabases.

In classifying the peridotites the varietal distinctions are based upon the prevailing accessory mineral. We thus have:

*Dunite*, consisting essentially of olivine only.

*Saxonite*, consisting essentially of olivine and enstatite.

*Picrite*, consisting essentially of olivine and augite.

*Hornblende picrite*, consisting essentially of olivine and hornblende.

*Wehrlite* (or eulysite), consisting essentially of olivine and diallage.

*Lherzolite*, consisting essentially of olivine, enstatite, and augite.

The name Dunite was first used by Hochstetter and applied to the olivine rock of Mount Dun, New Zealand. (Specimen 70346.) Saxonite was given by Wadsworth, rocks of this type being prevalent in Saxony. The same rock has since been named Harzburgite by Rosenbusch. The name Lherzolite is from Lake Lherz in the Pyrenees.

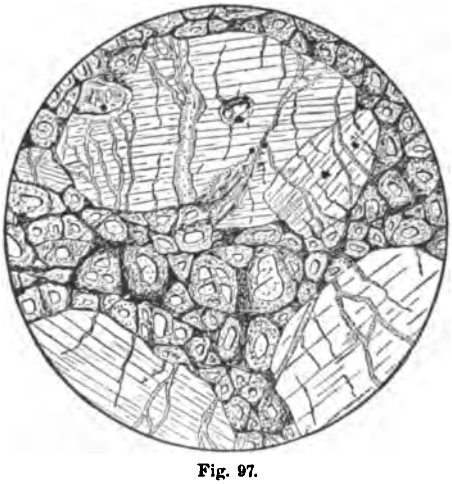

Fig. 97.
MICRO-STRUCTURE OF PORPHYRITIC LHERZOLITE.

The peridotites are, as a rule, highly altered rocks, the older forms showing a more or less complete transformation of their original constituents into a variety of secondary minerals, the olivine going over into serpentine or talc and the augite or hornblende into chlorite. The more common result of the alteration of peridotitic rocks is the conversion into serpentine, which takes place through the hydration of the olivine and the liberation of free iron oxides and chalcedony. (See Fig. 97.) Recent investigations have shown that a large share of the serpentinous rocks were thus originated. Hence a part of the serpentines are here exhibited

(See specimens 39014, 70137, and 70556, from California, England, New York State.) Those resulting from the hydration of other magnesian silicate minerals are to be found grouped with the unaltered rocks of the same nature. (See also exhibit illustrating the origin of serpentine.)

It is, perhaps, as yet too early to state definitely that all peridotites are eruptive. In many instances their eruptive nature is beyond dispute. Others are found in connection with the crystalline schists, so situated as to suggest that they may themselves be metamorphic.[*] Owing to their basic nature and low fusing points the peridotites have not, as a rule, been productive of pronounced contact metamorphism. They have of late excited considerable interest from their supposed connection with the origin of the diamond. (See under head of picrite porphyrites, p. 585.)

The peridotites are rocks of wide distribution, but covering comparatively limited areas. The following are the principal varieties and localities represented:

*Dunite:* Near Webster, North Carolina, 39131 and 29004; Corundum Hill, Macon County, North Carolina, 36845; Wake County, North Carolina (serpentine), 39030; Red Hill, Plumas County, California, 38361; Cumberland, Rhode Island (Cumberlandite), 39034; Dun Mountain, New Zealand, 70346.

*Saxonite:* San Francisco, California, 39014; Riddle, Oregon, 70600; Lizard district, Cornwall, England (serpentine), 39011; Cadgwith district, Cornwall, England (serpentine), 70137; near Tromsoe, Norway, 35758.

*Picrite:* Ilchester, Maryland, 69551; Little Deer Isle, Maine, 39044; Clickerton, Cornwall, England, 39010; Biedenkoff, Hesse Nassau, Prussia, 36578, (Palæopikrite) 36579; Tringenstein, Nassua, 36580.

*Hornblende Picrite:* Stony Point, New York, 38339. Madison County, Montana.

*Wherlite (Eulysite):* Near Red Bluff, Madison County, Montana, 70675; Volpersdorf, Silesia, 34766; Schriesheim, Baden, 36581; Terra di Zanschetta, Bologna, Italy, 36584 and 36585; Monte Ferrato, near Prato, Florence, Italy, 73057.

*Lherzolite:* Lherz, France, 38240; Areige, France, 6731; Arguenos, Haute Garonne, France, 36582; Fauraft, Markirch, in the Vosages Mountains, 36585.

The following are so much altered that they can be designated simply *serpentines:*

Deer Isle, Maine, 39047; Lynnfield, Massachusetts, 70140; Hoosac, Berkshire County, Massachusetts, 27205; Russell, Massachusetts, 38403; Blandford, Massachusetts, 38405; Bare Hills, near Baltimore, Maryland, 37435; Saliwick Lake, Alaska, 37027; Kupperberg, in the Fichtelgebirge, Bavaria, 36583; Greipendorf, Saxony, 36673; Waldheim, Saxony, 36675; Rauenthal, Vosges Mountains, 36587; Grumberg, Silesia, 34765; Japan, 27136.

### 9. THE PYROXENITES.

Pyroxenite, a term applied by Dr. Hunt[†] to certain rocks consisting essentially of minerals of the pyroxene group, and which occurred both as intrusive and as beds or nests intercallated with stratified rocks. The curator here follows the nomenclature and classification adopted by Dr. G. H. Williams.[‡]

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[*] See Kalkowsky's Elemente der Lithologie, p. 242.

[†] Geology of Canada, 1863, p. 667.

[‡] American Geologist, vol. I, July, 1890, pp. 35–49.

*Mineral composition.*—The essential constituents are one or more minerals of the pyroxene group, either orthorhombic or monoclinic. Accessory minerals are not abundant and limited mainly to the iron ores and minerals of the hornblende or mica groups.

*Chemical composition.*—The following analyses serve to show the variations which are due mainly to the varying character of the pyroxenic constituents:

| | I. | II. | III. |
|---|---|---|---|
| Silica | 50.80 | 53.98 | 55.14 |
| Alumina | 3.40 | 1.32 | 0.[illegible] |
| Chrome oxide | 0.32 | 0.53 | 0.25 |
| Ferric oxide | 1.39 | 1.41 | 3.46 |
| Ferrous oxide | 8.11 | 3.90 | 4.73 |
| Manganese | 0.17 | 0.21 | 0.03 |
| Lime | 12.31 | 15.47 | 8.39 |
| Manganesia | 22.77 | 22.50 | 26.66 |
| Soda | Trace | ........ | 0.30 |
| Potash | Trace | ........ | ........ |
| Water | 0.52 | 0.83 | 0.36 |
| Chlorine | 0.24 | ........ | 0.25 |
| Total | 100.03 | 100.24 | 100.[illegible] |

(I) Hypersthene diallage rock, Johnny Cake road, Baltimore County, Maryland; (II) hypersthene diallage rock, Hebbville post-office, Baltimore County, Maryland, and (III) bronzite diopside rock, from near Webster, North Carolina.

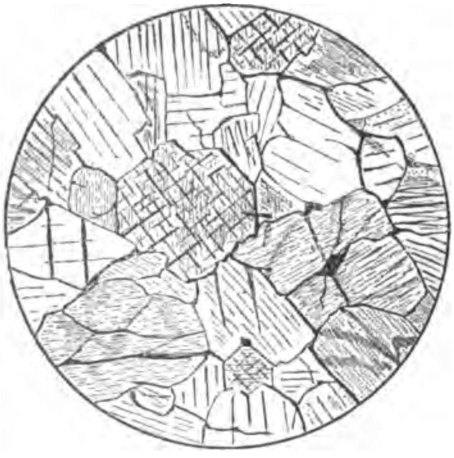

Fig. 98.
MICRO-STRUCTURE OF PYROXENITE.

*Structure.*—The pyroxenites are holocrystalline granular rocks, at times evenly granular and saccharoidal, or again porphyritic, as in the websterite from North Carolina (specimens 38832 and 17927). The microscopic structure of this rock is shown in Fig. 98 from the original drawing by Dr. Williams.

*Colors.*—The colors are, as a rule, greenish or bronze.

*Classification and nomenclature.*—The pyroxenites, it will be observed, differ from the peridotites only in the lack of olivine. Following Dr. Williams's nomenclature, we have the varieties Dillagite, Bronzitite, and Hypersthenite, according as the mineral dillage, bronzite, or hypersthene forms the essential constituent. Websterite is the name for the enstatite-dillage variety, such as occurs near Webster, North Carolina (specimens 38832, 39132, and 70060), and hornblendite that of the hornblende augite variety. Through hydration and other chemical changes the pyroxenites give rise to serpentinous, hornblendic, and steatitic masses, as shown in specimens from Chester, Pennsylvania, and Russdorf, Saxony. The rocks appear to rank in geological importance next to the peridotites.

The following localities are represented:

Chester County, Pennsylvania (these rocks all more or less altered into impure serpentine), 25669, 38467, 38470, 38471, 38473, 38491, 38498, 38484, 70[illegible]0 (williamsite), and 70154; near Webster, Jackson County, North Carolina, 70060, 38832, 39132; Russdorf and Kuhschnappel, Saxony, 36674 and 70191, Madison County, Montana, 73175.

### B.—EFFUSIVE OR VOLCANIC ROCKS.

This group includes those igneous rocks which, like the plutonics, have been forced up through the overlying rocks, but which in this case came nearly or quite to the surface and flowed out as lavas. They therefore in many cases represent merely the upper portions of plutonic rocks, from which they differ structurally, having become less perfectly crystalline, owing to their more rapid cooling and solidification. The characteristic structure of the group is porphyritic, and represents two distinct phases of cooling and crystallization; (1) an intratellurial period marked by the crystallization of certain constituents while the magma, still buried in the depth of the earth, was cooling very gradually, and (2) an effusive period marked by the final consolidation of the rock on the surface. As this final cooling was much the more rapid the ultimate product is a glassy, felsitic, or sometimes holocrystalline groundmass inclosing the porphyritic minerals formed during the first or intratellurial stage. (See structural series and Figs. 3 and 4, Pl. CXX.) Those portions which have cooled wholly on the surface often show not merely a vitreous form, but are vesicular or pumiceous as well from the expansion of the included aqueous vapor. When the groundmass is holocrystalline the rock is said to have a *holocrystalline porphyritic* structure; when glassy, a *vitrophyric* structure. An intermediate form in which the groundmass is in part crystalline and in part glassy is called *hypocrystalline porphyritic*. As would naturally be expected, the rocks of this group form a series in part parallel with those of the plutonic group, though as a matter of fact, as noted below, effusive forms occur of which no plutonic equivalents have as yet been found.

According to the geologic period of their extravasation, whether pre-Tertiary or Tertiary and post-Tertiary, many authorities have found it convenient to divide the rocks of this group into (1) the older or *paleovolcanic* effusives, and (2) the younger or *neovolcanic* effusives. This distinction is, however, not well marked and can be of little permanent value. It is nevertheless recognized to a certain extent here, inasmuch as it is upheld in the leading text-book on the subject, and, moreover, in most instances the names which have been applied to the Tertiary and post-Tertiary effusives differ from those applied to rocks of the Paleozoic ages, of which they may be otherwise almost exact equivalents.[*] The following table shows the relationship such as exists between the plutonics and the effusives so far as now known:

| Plutonics. | Effusives. | |
|---|---|---|
| | Paleovolcanic. | Neovolcanic. |
| Granites | Quartz porphyries | Liparites. |
| Syenites | Quartz-free porphyries | Trachytes. |
| Nepheline Syenites | (Not known) | Nepheline Phonolites. |
| Diorites | Porphyrites | Andesites. |
| Gabbros, Norites, Diabases | Melaphyrs and Augite porphyrites. | Basalts. |
| Theralites | (Not known) | Thephrites and Basanites (in part). |
| Peridotites | Picrite porphyrites | Limburgites. |
| Pyroxenites | (Not known) | Augitites (?). |
| (Not known) | do | Leucite Rocks. |
| Do | do | Nepheline Rocks. |
| Do | do | Melilite Rocks. |

In the collections the effusives are arranged in the order given below: (1) Quartz porphyries, (2) Liparites, (3) Quartz-free porphyries, (4) Trachytes, (5) Phonolites, (6) Porphyrites, (7) Andesites, (8) Melaphyrs and Augite porphyrites, (9) Basalts, (10) Tephrites and Basanites, (11) Picrite porphyrites, (12) Limburgites and Augitites, (13) Leucite Rocks, (14) Nepheline Rocks, and (15) Melilite Rocks.

### 1. THE QUARTZ PORPHYRIES.

*Composition.*—The mineral and chemical composition of the quartz porphyries is essentially the same as that of the granites, from which they differ mainly in structure. Their essential constituents are quartz and feldspar, with accessory black mica or hornblende in very small quantities; other accessories present, as a rule, only in microscopic quantities, are magnetite, pyrite, hematite, and epidote.

*Structure.*—The prevailing structure is porphyritic. To the unaided eye they present a very dense and compact groundmass of uniform reddish, brown, black, gray, or yellowish color, through which are scattered clear glassy crystals of quartz alone, or of quartz and feldspar together. The quartz differs from the quartz of granites in that here it was the first mineral to separate out on cooling, and hence has taken on a more perfect crystalline form; the crystal outlines of the feldspar are also well defined. Under the microscope the groundmass in the typical porphyry is found to consist of a dense felt-like or felsitic irresolvable substance, which chemical analysis shows to be also a mixture of quartzose and feldspathic material. The porphyritic quartzes show frequently a marked corrosive action from the molten magma, the mineral having again been partially dissolved after its first crystallization. (Fig. 3, Pl. CXX.) This difference in structure in rocks of the same chemical composition is believed to be due wholly to the different circumstances under which the two rocks have solidified from a molten magma. The structure of the groundmass is not always felsitic, but may vary from a glass, as in the pitchstones of Meissen, Isle of Arran, and the Lake Lugano region, through spherulitic, micropegmatitic, and porphyritic to perfectly microcrystalline forms as in the microgranites. This difference in structure may be best understood by reference to transparencies Nos. 39075 and 39078 in the windows and to Pl. CXX, which show the microscopic structure of (1) granite from Sullivan, Hancock County, Maine, (2) micropegmatite from Mount Desert, Maine (specimen 70041), and (3) a quartz porphyry from Fairfield, Pennsylvania.

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[*] The Curator has not felt it incumbent upon himself here to substitute other names for those now commonly accepted by the best authorities. Such a proceeding would only increase the confusion now existing.

Marked fluidal structure is common as shown by the specimens in the structural series Nos. 35946 and 35959, and also in specimens 35959 and 26570, from Massachusetts and Minnesota. (See Pl. CXXVII.)

*Colors.*—The colors of the groundmass, as above noted, vary through reddish, brownish gray to black and sometimes yellowish or green. The porphyritic feldspars vary from red, pink, and yellow to snow-white and often present a beautiful contrast with the groundmass, forming a desirable stone for ornamental purposes. (Specimens 36244 and 36245, from Elfdalen, Sweden.)

*Classification and nomenclature.*—Owing to the very slight development of the accessory minerals mica, hornblende, etc., it has been found impossible to adopt the system of classification and nomenclature used with the granites and other rocks. Vogelsang's classification as modified by Rosenbusch is based upon the structure of the groundmass as revealed by the microscope. It is as follows:

| | |
|---|---|
| Groundmass holocrystalline granular | Micro-granite. |
| Groundmass holocrystalline, but formed of quartz and feldspar, aggregates rather than district crystals | Granophyr. |
| Groundmass felsitic | Felsophyr. |
| Groundmass glassy | Vitrophyr. |

Intermediate forms are designated by a combination of the names as *granofelsophyr*, *felsovitrophyr*, etc. The name felsite is often given to rocks of this group in which the porphyritic constituents are wholly lacking, as in specimens No. 38031 and 69571, from Saugus and Nahant, Massachusetts. The names *felstone* and *petrosilex* are also common, though gradually going out of use. *Elvanite* is a Cornish miners' term and too indefinite to be of great value. (Specimen 36188, from Cornwall, England). *Eurite*, now little used, applies to felsitic forms such as specimens 38245, 38254, and 38259, from Jura, France. The name *felsite-pitchstone* or *retinite* has been given to a glassy form with pitch-like luster such as occurs in dikes, cutting the old red sandstone on the Isle of Arran. *Kugel porphyry* is a name given by German writers to varieties showing spheroids with a radiating or concentric structure. (Specimen 36235, from Baden.) *Micropegmatite* is the term not infrequently applied to such as show under the microscope a pegmatitic structure. (Specimen 70041, from Mount Desert, Maine, and Fig. 2, Pl. cxx.) Various popular names as *leopardite* and *toadstone* are sometimes applied to such as Nos. 27587 and 35722, from near Charlotte, North Carolina, and the peculiar spherlitic form, from Newbury, Massachusetts, No. 70138.

The following localities and varieties are represented:

*Microgranite:* Friedrichsrode, Germany, 70234, 70744, and 70251; Muhlenthal, Poppenberg and Auersberg. In the Harz Mountains, Germany 36223, 36222, and 36224; Nassau, Saxony 36225; Norway 70250; Elfdahlen, Sweden 36232; Catalonia, Spain, 36233; Liskeard, Wheal Busy and Penhall Moor, Cornwall, England, 36228, 36229, and 36231.

*Granophyr:* Kirneckthal and Barr Alsace, in the Voges Mountains, Germany, 36234 to 36239 inclusive; Lake Lugano (Lago di Lugano) Switzerland, 36606, 3660, 36609, and 36611; Mount Desert, Maine (micropegmatite) 70038, 70041, 70042.

*Felsophyr:* Albany, Mount Kearsarge, Waterville, New Hampshire, 27973, 29599, 29591, 29601, 29605; Marblehead, Massachusetts, 35953, 35955, 35956, 35959, 35961; Nahant, Massachusetts, 69671; Saugus, Massachusetts, 38031; Newbury, Massachusetts, 70138; Hyde Park, Massachusetts, 35942; Hingham, Massachusetts, 35943; Charlotte, North Carolina, 35722 and 27587; St. Francois, Iron and Stone Counties, Missouri, 26406, 26341, 26593; Lake County, Minnesota, 26570 and 26630; Bradon, Wisconsin, 28503; Park County, Colorado, 68943 and 68921; Lake County, Colorado, 68861 and 68901; Washoe District, Nevada, 24052 and 24071; St. Catharine, Brazil, 69860; Cornwall, England, 36188; Isle of Arran, Scotland, 70375 and 70378; Freiberg, Adorf, Werdan, Grimma, Erdmansdorf, and Schoeneck, Saxony, 38351, 3867 to 3870, inclusive, 36227, 36248, and 73109; Dossenheim, Handschuhsheim, and Weinham, Baden, 36242, 36246, and 36255; Odenwald, Germany, 36241 and 36243; Jura, France, 38259, 38245, and 38254; Poeplitz, Bohemia, 348; Danemora and Elfdalen, Sweden, 36250, 36244, 36245, and 36247; Isle of Hogland, Russia, 27550.

*Vitrophyr:* Meissen and vicinity, Saxony, 3631, 3642, 3872, 3876 to 3880 inclusive, 411, 34678, 36252, 36258, 36259; Auer and Recoaro, in the Tyrol, 36253, 38879; Lake Lugano region, Switzerland, 73121; Isle of Arran, Scotland, 36200 and 70374.

### 2. THE LIPARITES.

*Mineral composition.*—These rocks may be regarded as the younger equivalents of the quartz porphyries, or the volcanic equivalents of the granites, having essentially the same mineral and chemical composition. The prevailing feldspar is the clear glassy variety of orthoclase known as sanidin; quartz occurs in quite perfect crystal forms often more or less corroded by the molten magmas, as in the porphyries, and in the minute, six-sided, thin platy forms known as tridymite. The accessory minerals are the same as those of the granites and quartz porphyries.

*Chemical composition.*—Below is given the composition (I) nevadite, from the northeastern part of Chalk Mountain, Colorado, as given by Cross.* (II) That of a rhyolitic form, from the Montezuma Range,

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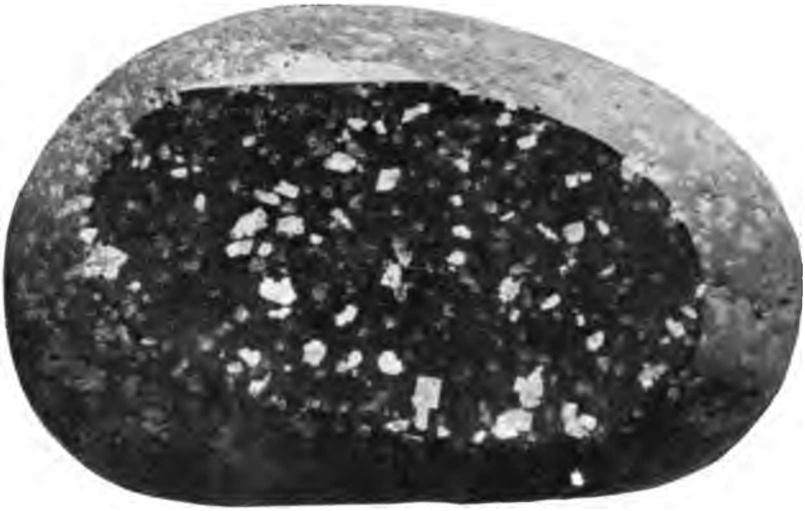
* Geology and Mining Industry of Leadville, Monograph XII, U. S. Geological Survey, p. 349.



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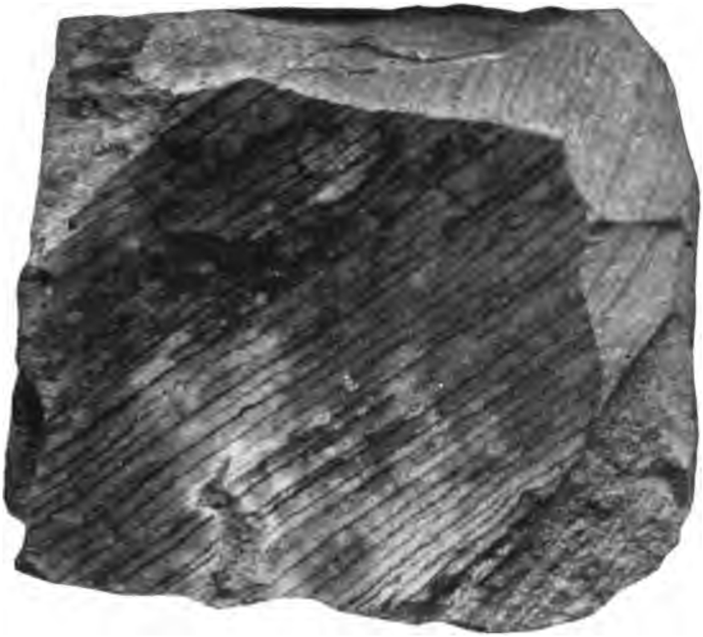

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FIG. 1. Quartz porphyry showing porphyritic structure. (Cat No. 35953, U. S. N. M.)
FIG. 2. Quartz porphyry showing flow structure. (Cat. No. 35946, U. S. N. M.)

Nevada, as given by King,* and (III) that of a black obsidian from the Yellowstone National Park, Wyoming, as given by Iddings.†

| | I. | II. | III. |
|---|---|---|---|
| | *Per cent.* | *Per cent.* | *Per cent.* |
| Silica | 74 45 | 74.62 | 74.70 |
| Alumina | 14.72 | 11.96 | 13.72 |
| Ferric oxide | None ... | 1.20 | 1.01 |
| Ferrous oxide | 0.56 | 0.10 | 0.62 |
| Ferric sulphide | ......... | ......... | 0.40 |
| Manganese | 0.28 | ......... | Trace. |
| Lime | 0.83 | 0.36 | 0.78 |
| Magnesia | 0.37 | ......... | 0.14 |
| Soda | 3.97 | 2.26 | 3.90 |
| Potash | 4.53 | 7.76 | 4.02 |
| Phosphoric anhydride | 0.01 | ......... | ......... |
| Ignition | 0.66 | 1.02 | 0.62 |
| | 100.38 | 99.28 | 99.91 |
| Specific gravity | ......... | 2.2 | 2.3447 |

*Colors.*—These are fully as variable as in the quartz porphyries; white, though all shades of gray, green, brown, yellow, pink, and red are common. Black is the more common color for the glassy varieties of obsidian, though they are often beautifully spotted and streaked with red or reddish-brown as shown in samples 72855 and 72856 from the Yellowstone Park, in 35268 from Glass Buttes, Oregon, 70252 from Mararatio, Mexico, 16248 from the Caucasus, and 11894 from Japan.

*Structure.*—The liparites present a great variety of structural features, varying from holocrystalline, through porphyritic and felsitic to clear, glassy forms. These varieties can be best understood by reference to the collections and Plates CXXVIII and CXXIX, prepared from photographs. Fig. 1, Pl. CXXVIII, is that of the coarsely crystalline variety nevadite from Chalk Mountains, Colorado; Fig. 2 is that of a common felsitic and porphyritic type; Fig. 3 is that of the clear, glassy form obsidian; Fig. 4 shows also an obsidian, but with a pumiceous structure; Figs. 1 and 2 on Pl. CXXIX show the hollow spherulites or lithophysæ, which have been studied and described by Mr. J. P. Iddings, of the U. S. Geological Survey.‡ Such forms are regarded by Mr. Iddings as resulting "from the action of absorbed vapors upon the molten glass from which they were liberated during the process of crystallization consequent upon cooling." A pronounced flow structure is quite characteristic of the rocks of this group as indicated by the name rhyolite. (See large sample of obsidian No. 72853, from Yellowstone National Park). The microscopic structure of a liparite from High Rock Cañon Nevada (35441), is shown in the colored transparency in the window (39079). Transitions from compact obsidian into pumiceous forms, due to expansion of included moisture, are common, as shown in the samples from the Mono Craters in California and those from the Lipari Islands.

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* Geological Exploration 40th Parallel, vol. I, p. 652.

† Annual Report U. S. Geological Survey, 1885–'86, p. 282.

‡ Obsidian Cliff, Yellowstone National Park, Annual Report U. S. Geological Survey, 1885–'86.

*Classification and nomenclature.*—The following varieties are now generally recognized, the distinctions being based mainly on structural features, as with the quartz porphyries. We thus have the granitic-appearing variety *nevadite*. The less markedly granular and porphyritic variety *rhyolite*, and the glassy forms *hyaloliparite*, *hyaline rhyolite*, or *obsidian* as it is variously called. Hydrous varieties of the glassy rock with a dull pitch-like luster are sometimes called *rhyolite pitchstone*.

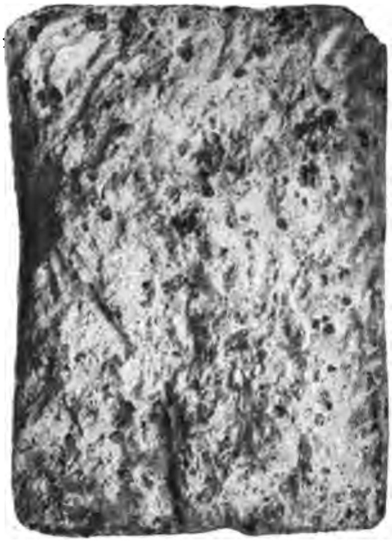
The name *rhyolite*, from the Greek word ῥέω, to flow, it may be stated, was applied by Richtofen as early as 1860 to this class of rocks as occurring on the southern slopes of the Carpathians. Subsequently Roth applied the name liparite to similar rocks occurring on the Lipari Islands. The first name, owing to its priority, is the more generally used for the group, though Professor Rosenbusch in his latest work has adopted the latter. The name *nevadite* is from the State of Nevada and was also proposed by Richtofen. The name obsidian as applied to the glassy variety is stated to have been given in honor of Obsidius, its discoverer, who brought fragments of the rock from Ethiopia to Rome. The name *pantellerite* has been given by Rosenbusch to a liparite in which the porphyritic constituent is anorthoclase.

The following localities and varieties are now represented:

*Nevadite:* Ten Mile District, Summit County, Colorado, 36872 and 36392; Chalk Mountain, Lake and Summit Counties, 73176; Apati, Hungary (Felso-Nevadite) 36269.

*Rhyolite:* Near Cortez, Nevada, 35361; Golanda Cañon, Sonoma Range, Nevada, 35327; south end of High Rock Cañon, Nevada, 35357; south end of Ha-wa-wa Mountains, Utah, 35308; Beaver Head Cañon, Montana, 36779; south of Cherry Creek, west side of Madison Valley, Madison County, Montana, 72945; Mount Sheridan, Wyoming, 38835; Yellowstone Cañon, Yellowstone Park, Wyoming, 28829; summit of Flat Mountain, Wyoming, 28643; Pima and Cochiel Counties, Arizona, 28578; Rattlesnake Hill and Querida, Custer County, Colorado, 36871, 36868, and 36870; Hidalgo, Santa Rosa, Zacatecas and Tezintlan, Mexico, 34995, 37734, 37689, 37730, and 37987; Bear Creek Falls, Shasta County, California, 70591; Schemnitz, Eisenbach, Hlinik, Glashutte, Nagy Tolesva, Kremnitz, Hungary, 34590, 36263, 36267, 36266, 36264, 36270, 36271, 36265, 36268, and 70122; Berkune and Kuckstein, in the Siebengebirge, Prussia, 36261, and 36262.

*Hyalo-liparite; obsidian:* Crater south side of Mono Lake, California, 22901 and 22899; *ibid.* (pumiceous forms), 22904 and 22907; Mono Lake, 8 specimens showing compact and pumiceous forms, 29630, 29631, 37210, 37211; same locality, showing spherulites, 35274; Upper Pit River, California, 1675; Deer Creek Meadows (spherulitic), 38364; Glass Buttes, Oregon, 35268 and 35267; Coyote Springs, Utah, 35265; Beaver Valley, Utah, 35269; obsidian cliffs in the Yellowstone National Park, 10569, 18969, 72855 and 72856; the same locality (spherulitic forms), 18962, 28921, 29106, 10574, 29107, 70676, and 28979; the same locality, with lithophysæ 72852; Obsidian cañon, Yellowstone National Park, 28922, 28923, and 10570; between Madison River and Shoshone Lake, Wyoming, 28914 and 28917; south



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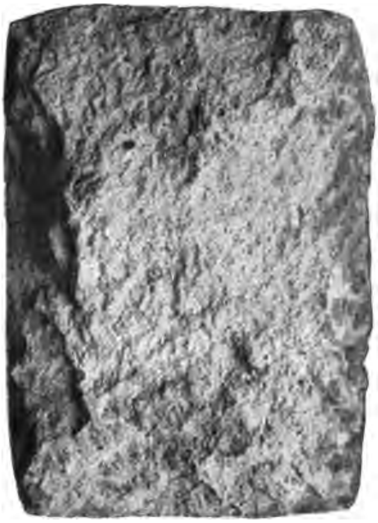

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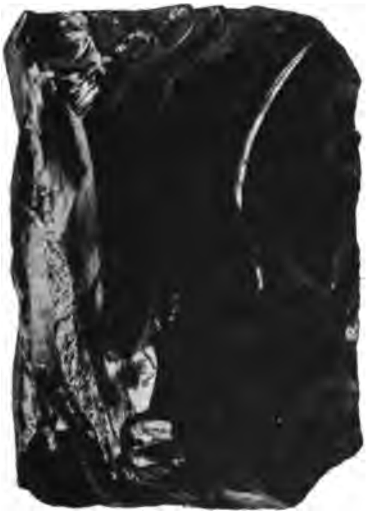

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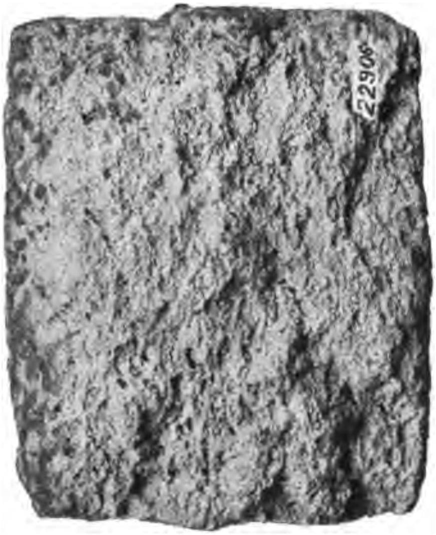

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FIG. 1. Liparite, pumiceous form. (Cat. No. 22906, U. S. N. M.)
FIG. 2. Liparite, obsidian form. (Cat. No. 28922, U. S. N. M.)
FIG. 3. Liparite, rhyolite form. (Cat. No. 72870, U. S. N. M.)
FIG. 4. Liparite, nevadite form. (Cat. No. 73176, U. S. N. M.)

base of Mount Washburn, Wyoming, 28975; east side of Snake River, Wyoming, 37273; Mararteo, Magdalena, Michoacan and Rio del Norte, Mexico, 70252, 35780, 19536, and 19,547; San Juan de los Llanos, Mexico (perlitic), 38130; Guatemala, 35587; Alaska, Beach near Nonikaket River, 6384; island of Lipari, 36184 and 36143; (8 specimens showing common types) *ibid.*, 36284; Ascension Island, 36281; New Zealand, 36110; Mayor Island, Bay of Plenty, New Zealand. 70345; Northeast Iceland, 72810; Mount Gokshi in the Caucasus, 16248; Tokaz, Hungary, 36280; Japan, 11894; Granada, Spain (perlitic), 35720.

*Hyalo-liparite*, pitchstone.—North slope of Salient Mountain, Nevada, 35402; Esmeralda district, Nevada, 15567 and 15562; south end of Carson Lake, Nevada, 35351; Clear Creek, Colorado, 36988; Rio Grande, Colorado, 5124; Sonora, Mexico, 7058; Grand Cañon Yellowstone River (porphyritic), 36830; Spring Valley, Utah (spherulitic), 1025; Mount Rotaro, Isle of Ischia, 36282; Gallatin Valley, Montana, 73116.

### 3. THE ORTHOCLASE OR QUARTZ-FREE PORPHYRIES.

*Mineral composition.*—The essential constituents are the same as those of syenite. They consist therefore of a compact porphyry groundmass with porphyritic feldspar (orthoclase) and accessory plagioclase, quartz, mica, hornblende, or minerals of the pyroxene group. More rarely occur zircon, apatite, magnetite, etc., as in the syenites.

*Chemical composition.*—Being poor in quartz these rocks are a trifle more basic than the quartz porphyries which they otherwise resemble. The following is the composition of an orthoclase porphyry from Predazzo as given by Kalkowski:* Silica, 64,45; alumina, 16.31; ferrous oxide, 6.49; magnesia, 0.30; lime, 1.10; soda, 5.00; potash, 5.45; water, 0.85 per cent.

*Structure.*—Excepting that orthoclase is the porphyritic constituent they are structurally identical with the quartz porphyries, and need not be further described here.

*Colors.*—These are the same as the quartz porphyries already described.

*Classification and nomenclature.*—The orthoclase or quartz-free porphyries bear the same relation to the syenites as do the quartz porphyries to granite, and the rocks are frequently designated as syenite porphyries. Like the quartz porphyries they occur in intrusive sheets, dikes and lava flows associated with the Paleozoic formations. Owing to the frequent absence of accessory minerals of the ferro-magnesia group the rocks can not in all cases be classified as are the syenites, and distinctive names based upon other features are often applied. The term orthophyr is applied to the normal orthoclase porphyries, and these are subdivided when possible into biotite, hornblende, or augite orthophyr according as either one of these minerals is the predominating accessory. The term ***rhombporphyry*** has been used to designate an orthoclase porphyry found in Southern Norway, and in which the porphyritic constituent appears in characteristic rhombic outlines, and which is further distinguished by a complete absence of quartz and rarity of hornblende. (Specimens 1660 and 34831.) The name *keratophyr* has been given by Gümbel to a quartzose or quartz-free porphyry containing a sodium-rich alkaline feldspar. (Specimens 70609, Minnesota; 70194 and 70195, Bavaria; 70186, Hartz Mountains; and 70564, Bomelö, Norway.)

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*Elemente der lithologie, p. 86.

So far as can be at present judged, these rocks are much more restricted in their occurrence than are the quartz porphyries.

The following localities and varieties are represented:

Andlau, Vosges Mountains, Germany, 36304; Hohwald, Vosges Mountains, 36303; Katzenellnogen, Nassau, Germany, 36302; Oldenwald Hesse, Germany, 36301; Christiania Fjord, Norway, 1680; near Christiania, Norway (orthophyr), 70413; Tyvehomen, near Christiania, Norway (rhomb-porphyry), 1660, 34381, and 36456; Pigeon Point, Minnesota (Keratophyr), 70609; Torkel in the Fichtelgebirge, Bavaria (Keratophyr), 70194; Bavaria, 70195; Elbingerode, Hartz Mountains, Germany, 70186; Bammelo, Norway (Keratophyr), 70564.

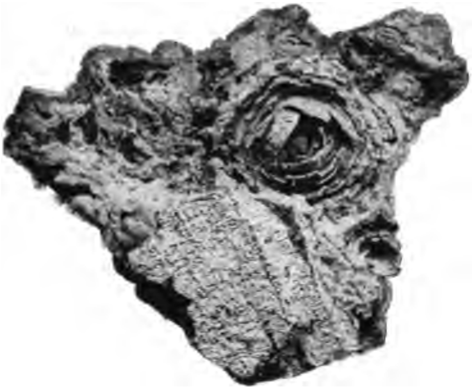
### 4. THE TRACHYTES.

Trachyte from the Greek word τραχυς, rough, in allusion to the characteristic roughness of the rock. The term was first used by Hauy to designate the well-known volcanic rocks of the Drachenfels on the Rhine.

*Mineral composition.*—Under the name of trachyte are comprehended by Professor Rosenbusch those massive Tertiary and post-Tertiary eruptive rocks, consisting essentially of sanidin with hornblende augite or black mica, and which may be regarded as the younger equivalents of the quartz-free porphyries. The common accessory minerals are plagioclase, tridymite, apatite, sphene, and magnetite, more rarely olivine (specimen 72988 from the Isle of Ischia); sodalite (specimens 36320, 36321, and 72994 from the Isle of Ischia, and specimens 73013, 73014, and 73017 from near Naples, Italy); humite (specimen 36331 from Monte Somma); hauyne (specimens 36315 to 36317 from the Laacher See), and mellilite (specimen 72997 from Isle of Ischia).

*Chemical composition.*—The following shows the range in chemical composition of these rocks (I) being that of the trachyte of Game Ridge, Colorado (see specimen 70605) and (II) that of the La Guardia stone. (See specimens 38788 and 73004).

| | I. | II. |
|---|---|---|
| | *Per cent.* | *Per cent.* |
| Silica | 66.03 | 56.[illegible] |
| Alumina | 18.49 | 26.[illegible] |
| Ferric oxide | 2.18 | 1.[illegible] |
| Ferrous oxide | 0.22 | ........ |
| Manganese oxide | Trace. | Trace. |
| Lime | 0.96 | 3.[illegible] |
| Magnesia | 0.39 | 2.[illegible] |
| Potash | 5.86 | 6.[illegible] |
| Soda | 5.22 | 3.[illegible] |
| Ignition | 0.85 | 1.[illegible] |
| Phosphoric acid ($P_2O_5$) | 0.04 | ........ |
| Total | 100.24 | 100.[illegible] |



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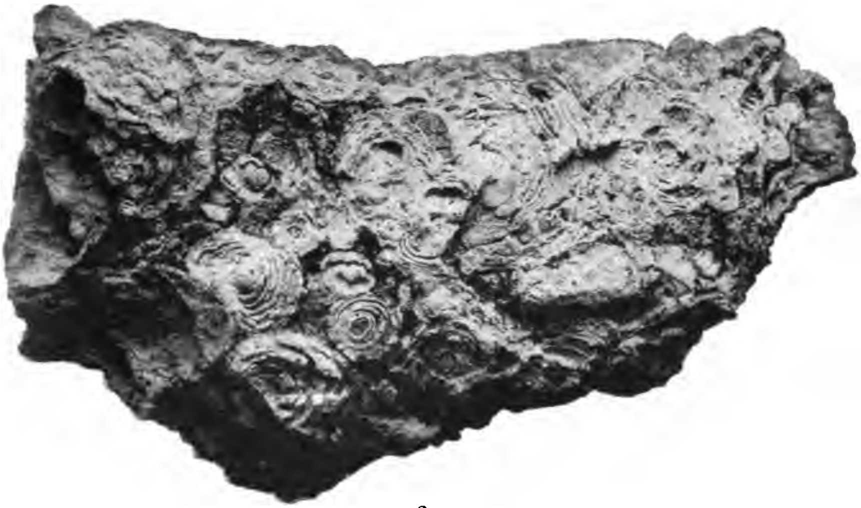

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Obsidian with lithophysæ. (Cat. No. 72851, U. S. N. M.)

*Structure.*—In structure the trachytes are rarely granular, but possess a fine, scaly or microfelsitic groundmass, rendered porphyritic through the development of scattering crystals of sanidin, hornblende, augite of black mica. The texture is porous, and the rock possesses a characteristic roughness to the touch; hence the derivation of the name as given above. Perlitic structure is common in the glassy forms. The microscopic structure of the trachyte of Monte Vetta is shown in Fig. 5, Plate CXX, as prepared from specimen 36332.

*Colors.*—The prevailing colors are grayish, yellowish, or reddish.

*Classification and nomenclature.*—They are divided into hornblende, augite or mica-trachytes, according as any one of these minerals predominates. The name *sanidin-oligoclase trachyte* is sometimes given to trachytes in which both these feldspars appear as prominent constituents. (See specimens from the Siebengebirge, Prussia.) The presence of quartz gives rise to the variety *quartz-trachytes*. (See under rhyolites.) The glassy form of trachyte is commonly known under the name of the *trachyte pitchstone* (specimens 36272, 36276, and 38786 and 72995 from Hungary, Isle of Ponza, and the Isle of Ischia), or if with a perlitic structure simply as perlite. (Specimens 36277, 36278 and 36279 from Hungary.) In his most recent work Professor Rosenbusch has included the glassy forms under the name of *hyalo-trachyte*.

The following localities and varieties are represented.

*Trachyte:* Game Ridge, near Rosita, Silver Cliff Region, Colorado, 70605; near Carbonate Camp, Black Hills, Dakota, 39097; Isle of Ischia, 36320 to 36326, inclusive, 38336, 35857, and 72,994 to 72998, inclusive; Euganaen Hills, Italy, 36318 and 36319; near Naples, Italy, 36314, 73013, 73014, and 73017; Monte Verginio, Rome, Italy, 36328; Astroni, Naples, Italy, 36327; Monte Bracalon, Italy, 34792; Monte Nuovo, Naples, Italy, 36329; Monte Somma, Italy, 36330 and 36331; Laacher See, Prussia, 36315, 36316, and 36317; Isle of Ponza, Italy, 38788 and 73004; Isle of St. Stefano, 73007; Visegrad, Apatkuter, Hungary, 34569; Moscar, Hungary (Biotite Hypersthene Trachyte), 70183; Hlinik, Hungary (pumiceous), 36312; the Siebengebirge, Prussia, 34644, 36305 to 36308, inclusive, and 36348; Hulsberg, Nassau, Germany (Sanidin-oligoclase-trachyte), 36310; Inselberg, Prussia (sanidin-oligoclase-trachyte), 36311.

*Hyalo trachyte—trachyte pitchstone.*—Hlinik, Hungary, 36272; Kozelnik, Hungary, 36376; Isle of Ponza, 38786; Pusti Hrad, Hlinik and Kremnitz, Hungary (Perlitic varieties), 36277, 36278, and 36379.

### 5. THE PHONOLITES.

Phonolite, from the Greek word φωνή, sound, and λίθος, stone, in allusion to the clear ringing or clinking sound which slabs of the stone emit when struck with a hammer; frequently called *clinkstone* for the same reasons.

*Mineral composition.*—The phonolites consist essentially of sanidin and nepheline or leucite, together with one or more minerals of the augite hornblende group, and generally hauyn or nosean. The common accessories are plagioclase, apatite, sphene, mica, and magnetite; more rarely occur tridymite, melanite, zircon, and olivine. The rock undergoes ready decomposition, and calcite, chlorite, limonite, and various minerals of the zeolite group occur as secondary products.

*Chemical composition.*—The average of six analyses given by Zirkel* is as follows: Silica, 58.02 per cent.; alumina, 20.03; iron oxides, 6.18; manganese oxide, 0.58; lime, 1.89; magnesia, 0.80; potash, 6.18; soda, 6.35; water, 1.88; specific gravity, 2.58.

*Structure.*—The phonolites present but little variety in structure, being usually porphyritic, seldom evenly granular. The porphyritic structure is due to the development of large crystals of sanidin, nepheline, leucite, or hauyn, and more rarely hornblende, augite, or sphene, in the fine-grained and compact groundmass, which is usually micro-crystalline, never glassy or amorphous.

*Colors.*—The prevailing colors are dark gray or greenish.

*Classification and nomenclature.*—Three varieties are recognized by Professor Rosenbusch, the distinction being founded upon the variation in proportional amounts of the three minerals sanidin, nepheline, or leucite. We thus have, 1st. *Nepheline-phonolite*, consisting essentially of nepheline and sanidin, and which may therefore be regarded as the volcanic equivalent of the nepheline syenite. 2d. *Leucite phonolite*, consisting essentially of leucite and sanidin, and 3d. *Leucitophyr*, which consists essentially of both nepheline and leucite in connection with sanidin, and nearly always melanite.

The following localities and varieties are represented:

*Nepheline-phonolite:* Black Buttes, Black Hills, Dakota, 39096 and 70603; Rio Janeiro, Brazil, 69974; Serra dos Pocos de Caldas, Prov. do S. Paulo, Brazil 6996; Serra de Tingua, Brazil, 69965 and 70237; Ilha de Fernando Poroula, Prov. de Pernambuco, Brazil, 69970 and 69971; Eifel, Rhenish Prussia, 36344; Ober Scheffhause Kaiserstuhl, Switzerland, 36346; Schlofsberg, Bohemia, 36347; Kleine Priese Bohemia, 36350; Kletschner Berg, Bohemia, (Nosean-sanidin phonolite), 363 Mileschauer, Mittelgebirge, Bohemia, (Nosean sanidin-phonolite), 36349; Hohen-Mahlberg, Nassau, Germany, 36345; Hohen Krahen, Baden, 38349 and 355 Gemersbold, Baden, 38350.

*Leucite-Phonolite:* Civata Castellana, Viterbo, Rocca Monfina, and Bagnoria Cim Mountains, Italy, 36541, 36540, 36562, and 38790.

*Leucitophyr:* Englenkopf, Eifel, Prussia, 38337; Burg Olbruck Eifel, Prussia, 357 and 36351; Dachsbusch, Laacher See, Prussia, 36352; Rieden and Perlerkopf Laacher See, Prussia, 36353 and 36354.

## 6. THE PORPHYRITES.

*Mineral and chemical composition.*—The essential constituents of the porphyrites are the same as of the diorites, from which they differ mainly in structure.

*Structure.*—The porphyrites, as a rule, show a felsitic or glassy groundmass, as do the quartz porphyries, in which are imbedded quite perfectly developed porphyritic plagioclases with or without hornblende or black mica. At times, as in the well known "porfido rosso antico," or antique porphyries of Egypt, the groundmass is micro-crystalline, forming thus connecting links between the true diorites and diorite porphyrites. Indeed the rocks of the group may be said to bear the same relation to the diorites in the plagioclase series as do the quartz porphyries to the granites in the orthoclase series, or better yet, they may be compared with the hornblende andesites, of which they are apparently the Palæozoic equivalents.

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* Lehrbuch der petrographie, II, p. 193.

*Colors.*—The prevailing colors are dark brown, gray, or greenish.

*Classification.*—According to the character of prevailing accessory mineral we have *hornblende porphyrite*, or *diorite porphyrite*, as it is sometimes called, and *mica porphyrite*. When, as is frequently the case, neither of the above minerals are developed in recognizable quantities, the rock is designated as simply *porphyrite*. The porphyrites are widespread rocks, very characteristic of the later Palæozoic formations, occurring as contemporaneous lava flows, intrusive sheets, dikes and bosses. The more important localities and varieties exhibited are given in the following list:

Elk Mountains, Colorado, head of Willow Creek, 39197; Mosquito Gulch, Park County, Colorado, 68976 and 68951; north slope Bartlett Mountains, Summit County, Colorado, 68972; Cedar Creek, Madison County, Montana, 72866 and 72880; Jefferson County, Montana, 73170; near Libertyville, New Jersey (mica porphyrite), 72830; Nantasket, Massachusetts, 38514; Terra del Fuego, South America, 1880; North Berwick, Law, England, 36386; Loch Fine, Argyleshire, Scotland, 70380 and 70381; Lake Lugano, 36622 and 36616, 36617 and 36618; Vallee du Lys, Pyrenees, 36375; Quenast, Belgium, 36377; Falkenstein, in the Fichtelgebirge, Bavaria, 36376; Hochwald and Gottesberg, Silesia, 36389 and 36390; Postchappel, Saxony, 36387; Gienberg, Theodorshall, Munster, Wertenberg, Gonnesweiler, Wolfstein, and Namborn (epidiorite porphyrite), Nahe, Prussia, 36379, 36380, 36381, 38384, 36388, 70242, 70185, 70205; Ilfeld, Hartz Mountains, 36385.

### 7. THE ANDESITES.

**Andesite.** The name was first used by L. V. Buch in 1835, to designate a type of volcanic rocks found in the Andes Mountains, South America.

*Mineral composition.*—The essential constituents are soda-lime feldspar, together with black mica, hornblende, augite, or a rhombic pyroxene, and in smaller, usually microscopic proportions, magnetite, ilmenite, hematite, and apatite. Common accessories are olivine, sphene, garnets, quartz, tridymite, orthite, pyrite, and sanidin.

*Chemical composition.*—The composition of the andesites varies very considerably, the quartz-bearing members naturally showing a much higher percentage of silica. The following table shows the composition of a few typical forms:

| | $SiO_2$ | $Al_2O_3$ | $Fe_2O_3$ | $FeO$ | $MgO$ | $CaO$ | $Na_2O$ | $K_2O$ | $H_2O$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 66.32 | 14.33 | 5.53 | 0.25 | 2.45 | 4.61 | 3.90 | 1.61 | 1.13 |
| 2 | 69.51 | 15.75 | 3.34 | ........ | 2.09 | 1.71 | 3.89 | 3.31 | ....... |
| 3 | 61.12 | 11.61 | 11.64 | ........ | 0.61 | 4.33 | 3.85 | 3.52 | 4.3 |
| 4 | 56.07 | 19.06 | 5.39 | 0.92 | 2.12 | 7.70 | 4.52 | 1.24 | 0.99 |
| 5 | 56.19 | 16.12 | 4.92 | 4.43 | 4.60 | 7.00 | 2.96 | 2.37 | 1.03 |
| 6 | 58.33 | 18.17 | ........ | 6.03 | 2.40 | 6.19 | 3.20 | 3.02 | 0.76 |

1 Dacite from Kis Sibes Transylvania.
2 Dacite from Lassens Peak, California.
3 Hornblende andesite from hill north of Gold Peak, Nevada.
4 Hornblende andesite from Bogoslof Island, Alaska.
5 Hypersthene andesite, Buffalo Peaks, Colorado.
6 Augite andesite from north of American Flat, Washoe, Nevada.

*Structure.*—To the unaided eye the andesites present as a rule a compact, amorphous, often rough and porous groundmass carrying porphyritic feldspars and small scales of mica, hornblende, or whatever may be the prevailing accessory; pumiceous forms are not uncommon (specimens 35516 and 36979). Under the microscope the groundmass is found to vary from clear glassy through microlitic forms to almost holocrystalline. The minerals of the groundmass are feldspars in elongated microlites, specks of iron ore, apatite in very perfect forms, and one or more of the accessory ferro-magnesian minerals. The porphyritic constituents present well developed crystalline outlines, or having once been fully developed have suffered from the corrosive action of the molten magma, the feldspars being rounded, and the hornblendes displaying a characteristic black border. A pronounced flow structure is usually developed. The micro-structure as seen by a low power is well shown in the colored transparency in the window number (39080).

*Colors.*—The prevailing colors are some shade of gray, greenish or reddish.

*Classification and nomenclature.*—Specific names are given dependent upon the character of the prevailing accessory. We thus have:

Andesites with quartz=*Quartz andesites* or *dacites*
Andesites in which hornblende prevails=*Hornblende andesites.*
Andesites in which augite prevails=*Augite andesites.*
Andesites in which hypersthene prevails=*Hypersthene andesites.*
Andesites in which mica prevails=*Mica andesites.*

The glassy varieties are often known as *hyaline andesites.* The name *propylite* was given by Richthofen to a group of andesitic rocks prevalent in Hungary, Transylvania, and the western United States (specimens No. 36414 and 35323 from Colorado and Nevada and 36481 from Hungary), but these rocks have since been shown by Wadsworth and others to be but altered andesites, and the name has fallen into disuse.

The following varieties and localities are represented:

*Quartz andesite:* Dacite. Lassen's Peak, California, 70597; State of Mexico, Mexico, 37716; Nagy Ag, Transylvania, 34587 and 34575; Schemnitz, Hungary, 70180 and 70181; Kis Lebes, in the Siebengebirge, 36391.

*Hornblende andesite:* Pelican Peak, Wyoming, 28900 and 28901; north end of Mono Valley, Nevada, 35497; Mountain Pass, between Bodie and Mono Lake, 35469; Mullin's Ranch, west shore of Pyramid Lake, Nevada (propylite), 35323; Washoe District, Nevada, 24001, 24020, 24026, 24121; south slope Sepulchre Mountain, Yellowstone National Park, 72860; road from Ennis to Virginia City, Madison County, Montana, 72867; Mount Shasta, California, 38362 and 36977; Bogosloff Island, Alaska, 36855 and 37033; Buckskin Gulch, Colorado (propylite), 36414; Oaxaca, Mexico, 37752; Mexico, Mexico, 37770; Ixtapalapa, Mexico, 37711; the Siebengebirge, Prussia, 34579, 34580, 34581, 36400 to 36406 inclusive; Sengelberg, near Salz, Nassau, Germany, 36409; Dahlen, Nassau, Germany, 36407; Wolferding, Nassau, Germany, 36408; Gyalu, Transylvania, 36411; Com Neograd, Hungary, 34585.

*Hypersthene andesite:* Mount Shasta, California, 36978 and 38363; *ibid*, (pumiceous) 36979; Mono Craters, California, 37216; Zacatecas, Mexico, 37707; Mexico, Mexico, 37712; Volcano of Krakatoa (pumiceous), 35516.

*Mica andesite:* Geisberg in the Siebengebirge, Rhenish Prussia, 36393; Dilln, Repistye, Kremnitz, Tepla, and Schemnitz, Hungary, 36394, 36395, 36396, 36398, 36399, 70182, 70185; Monte di Capucini, near Viterbo, Italy (with hypersthene), 36397.

*Augite andesite:* Southeast side of Mono Lake, near Mono Springs Station, California, 35439; west side Humboldt Valley, 35465; Washoe District, Nevada, 24018; near Fort Ellis, Gallatin County, Montana, 38577; South Boulder Creek, Montana (with hypersthene), 73167; Kremnitz, Hungary, 34577, 36484 and 36486; Nagy Banya, Hungary, 36485; Schemnitz, Hungary, 36116, 36482, 34576, 34578; Tokaj, Hungary (with hypersthene), 36487; Bath, Hungary (spherulitic, with hypersthene), 36488; Bagonya, Hungary (with hypersthene), 36489; Kis Kapus, transylvania, 36483; Monte St. Croce, Roccamonfina, Italy (with mica), 73021.

### 8. THE MELAPHYRS AND AUGITE PORPHYRIES.

The term melaphyr is used by Rosenbusch to designate a volcanic rock occurring in the form of intrusive sheets and lava flows, and consisting essentially of a plagioclase feldspar, augite and olivine, with free iron oxides and an amorphous of porphyry base. The augite porphyrites differ in containing no olivine. The rocks of this group are therefore the porphyritic forms of the olivine bearing and olivine free diabases and gabbros, differing from these in structure, in mode of occurrence, and in belonging in great part to the Carboniferous and older Permian formations.

*Structure.*—As above noted they are porphyritic rocks with, in their typical forms, an amorphous base, are often amygdaloidal, and with a marked flow structure.

*Colors.*—In colors they vary through gray or brown to nearly black; often greenish through chloritic and epidotic decomposition, as shown in specimens No. 35940, from Brighton, Massachusetts.

*Classification and nomenclature.*—According as olivine is present or absent they are divided primarily into melaphyrs and augite porphyrites, the first bearing the same relation to the olivine diabases as do the quartz porphyries to the granites, or the hornblende porphyrites to the diorites, and the second a similar relation to the olivine free diabases. The augite porphyrites are further divided upon structural grounds into (1) *diabase porphyrite*, which include the varieties with holocrystalline diabase granular groundmass of augite, iron ores and feldspars, in which are embedded porphyritic lime-soda feldspars—mainly labradorite—idiomorphic augites, and at times accessory hornblende and black mica; (2) *spilite*, which includes the non-porphyritic compact, sometimes amygdaloidal and decomposed forms such as are known to German petrographers as *dichte diabase*, *diabase mandelstein*, (amygdaloid) *kalk-diabase*, *variolite*, etc.; (3) the true *augite porphyrite*, including the normal porphyritic forms with the amorphous base, and (4) the glassy variety *augite vitrophyrite.*

The following localities and varieties are represented:

*Melaphyr:* Hingham, Nantasket, and Brighton, Massachusetts, 38378, 38524, and 35940; Taylor's Falls, Minnesota, 26591; Berkshire Cañon, Virginia Range, Nevada, 22405; Ilfeld, in the Harz Mountains, 36474; Heimbach, Asweiler, Sotern and Erzweiler, Nahe, Prussia, 36472, 36469, 36471, and 36470; Berschweiler and Niederbrombach, Nahe, Prussia (Weiselbergite types), 70220 and 70233; Heisterberg, Reidscheid, Oberstein, and Hopstaten, Nahe, Prussia (navite types), 70219, 70221 to 70223 inclusive; Braunshausen, Nahe, Prussia (olivine tholeeit type), 70210; Gersdorf, Saxony, 36475; Neuhaus and Lahn, Silesia, 36473 and 36470.

*Augite porphyrite:* Barro de Oratorio, Rio Zubara, Province de Str. Catharina, Brazil, 69915; Durham, England, 36462; Christiania, Norway, 70398; Upsala, Sweden (uralite porphyrite), 70196; Bufaure and Fassathal, Tyrol, 36476, and 36461; Hof, in the Fichtelgebirge, Bavaria, 36459; Dillenburg, Baldwinstein, and Langenaubach, Nassau, Germany, 36457, 36460, and 36454; Rubeland, Harz Mountains, Germany, 36455; Elbingerode, Harz Mountains (diabase porphyrite, labradorite porphyrite), 36453; Rosenberg, Nahe, Prussia, 36458; Berneck, in the Fichtelgebirge, Bavaria (spilite type), 70174; Gebweiler, Alsace, Germany (labrodorite porphyrite), 36449, 36450, 36451, and 36452; Cottonwood Creek, Gallatin County, Montana, 38595; Cusel, Nahn, Prussia (cuselite type), 70192 and 70193.

## 9. THE BASALTS.

*Basalt*—A very old term used by Pliny and Strabo to designate certain black rocks from Egypt, and which were employed in the arts in early times.*

*Mineral composition.*—The essential minerals are augite and plagioclase feldspar with olivine in the normal forms; accessory iron ores (magnetite and ilmenite), together with apatite, are always present, and more rarely a rhombic pyroxene, hornblende, black mica, quartz, perowskite, hauyn and nepheline, and minerals of the spinel group. Metallic iron has been found as a constituent of certain basaltic rocks on Disco Island, Greenland (specimen 73164).

*Chemical composition.*—The composition is quite variable. The following shows the common extremes of variation: Silica, 45 % to 55 %; alumina, 10 % to 18 %; lime, 7 % to 14 %; magnesia, 3 % to 10 %; oxide of iron and manganese, 9 % to 16 %; potash, 0.058 %; soda, 2 % to 5 %; loss by ignition, 1 % to 5 %; specific gravity, 2.85 to 3.10.

*Structure.*—Basalts vary all the way from clear glassy to holocrystalline forms. The common type is a compact and, to the unaided eye, homogeneous rock, with a splintery or conchoidal fracture, and showing only porphyritic olivines in such size as to be recognizable. (See specimens Nos. 34752, 35852, and 36500.) Under the microscope they show a groundmass of small feldspar and augite microlites, with perhaps a sprinkling of porphyritic forms of feldspar, augite, and olivine, and a varying amount of interstitial brownish glass; the glass may be wholly or in part replaced by devitrification products, as minute hairs, needles, and granules. A marked flow structure is often developed, the feldspars of the groundmass having flowed around the olivine belonging to the earlier period of consolidation, giving rise to an appearance that may be compared to logs in a mill stream, the olivines representing small islands. (See transparencies No. 39081.) Pumiceous and amygdaloidal forms are common.

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* Teall. British Petrography, p. 136.

*Colors.*—The prevailing colors are dark, some shade of gray to perfectly black. Red and brown colors are also common. Mineralogically it will be observed the basalts resemble the olivine diabases and melaphyrs, of which they may be regarded as the younger equivalents. Indeed, in very many cases it has been found impossible to ascertain from a study of the specimen alone to which of the three groups it should be referred, so closely at times do they resemble one another.

*Classification and nomenclature.*—In classifying, the variations in crystalline structure are the controlling factors. As, however, these characteristics are such as may vary almost indefinitely in different portions of the same flow the rule has not been rigidly adhered to here. We thus have:

(1) *Dolerite*, including the coarse-grained almost holo-crystalline variety; (2) *Anamesite*, including the very compact fine-grained variety, the various constituents of which are not distinguishable by the unaided eye; (3) *Basalt* proper, which includes the compact homogeneous, often porphyritic variety, carrying a larger proportion of interstitial glass or devitrification products than either of the above varieties, and (4) *Tachylite*, *hyalomelan* or *hyalobasalt* which includes the vitreous or glassy varieties, the mass having cooled too rapidly to allow it to assume a crystalline structure. These varieties therefore bear the same relation to normal basalt as do the obsidians to the liparites. Other varieties, though less common, are recognizable and characterized by the presence or absence of some predominating accessory mineral. We have thus *quartz*, *hornblende*, and *hypersthene basalt*, etc. An olivine free variety is also recognized.

The basalts are among the most abundant and widespread of the younger eruptive rocks. In the United States they occur mainly in the regions west of the Mississippi River. They are eminently volcanic rocks and occur in the form of lava streams and sheets, often of great extent, and sometimes showing a characteristic columnar structure (see collections under head of structural geology). According to Richthofen the basalts are the latest products of volcanic activity. The quartz basalt from Snag Lake, near Lassen's Peak, California (No. 38604), is regarded by Mr. J. S. Diller as a product of the latest volcanic eruption in California, and perhaps in the United States (Alaska excepted). This lava field covered an area of only about 3 square miles, and trunks of trees killed at the time of the eruption are still standing.

The following localities and varieties are represented:

*Olivine free basalt:* Stoppelberg, near Wiensbach, Rhon Mountains, Prussia, 70254.

*Olivine basalt:* Beaver Head County, Montana, 38571; Valmont, Boulder County, Colorado, 36491; near Golden, Jefferson County, Colorado, 36874; Canadian Hills, New Mexico, 29173; Turkey Mountains, New Mexico, 29180; Washoe District, Nevada, 24054; Aurora, Nevada, 35477; Antelope Spur, Mt. Washburn, Wyoming, 29094; Madeline Valley, California, 25322; Ten-mile Creek, Quinn River Valley, Oregon, 35350; Gardiner's River, Yellowstone National Park, 72858; South of Eight-mile creek, west side of Madison Valley, Madison County, Montana, 72799; South branch Bear Creek, East side Madison Valley, Madison County, Montana (olivine rich variety), 72800; South of Cherry Creek, Madison County, Montana, 72944; Agate Pass, Cortez Range, Nevada, 21302; Basalt Hills, Kawsoh Mountains, Nevada, 21998; Unalashka, Alaska, 28076; Lehigh River, Victoria, Australia, 28193; Chatham Islands, Galapagos Archipelago, 70655; Finkenberg, near Bonn, Prussia, 36496; Lowenburg, Jungfernberg, Petersberg, and Oelberg in the Siebengebirge, 36490, 36492, 36493, and 36494; Unkel on the Rhein (Saulen basalt, near Limburgite), 36495; Limburg, Nassau, Germany, 36497; Alsfeld, Hesse, Germany, 36498; Tannenbergsthal in the Erzgeberge, 36499; Groditzberg, Silesia, 34752; Auvergne, France, 35858, San-Miguel, Azores Islands, 35522 and 35524; Zacatecas, Mexico, 37782 and 37786; Serena, Mexico, 37701; Disco Island, Greenland (with native iron), 12118; Thordarfell, Reykjavir, Iceland, 72807; Hawaiian Islands (rich in olivine) 35852.

*Quartz basalt:* Near Snag Lake, Lassen's Peak, California, 36604.

*Hornblende basalt:* Rossdorf, Rhon Mountains, Germany, 70264.

*Hyalobasalt—Tachylite:* Hilo, Hawaiian Islands, 70567; Kilauea, Hawaiian Islands, (Peles Hair), 72947; Gethurms, Vogelsberg, Prussia, 70261 and 70263; Rossdorf, Silesia, 70677.

### 10. THE TEPHRITES AND BASANITES.

*Mineral composition.*—The essential constituent of the rocks of this group as given by Rosenbusch are a lime-soda-feldspar and nepheline or leucite, either alone or accompanied by augite. Olivine is essential in basanite. Apatite, the iron ores, and rarely zircon occur in both varieties. Common accessories are sanidin, hornblende, biotite, hauyn (see specimen 34686 from Niedermendig), melanite, perowskite and a mineral of the spinel group.

*Chemical composition.*—The following is the composition of (I) a nepheline tephrite from Antao Pico da Cruz, Azores, and (II) a nepheline-basanite from San Antonio, Cape Verde Islands, as given by Roth.*

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*Abhandlungen der König. Akad. der Wissenschaften zu Berlin. 1884, p. LXIV.

| | I. | II. |
|---|---|---|
| | *Per ct.* | *Per ct.* |
| Silica | 47.44 | 43.09 |
| Alumina | 23.71 | 17.45 |
| Iron sesquioxide | 6.83 | 18.99 |
| Iron protoxide | 3.53 | ........ |
| Magnesia | 1.95 | 4.63 |
| Lime | 6.47 | 9.76 |
| Soda | 6.40 | 5.02 |
| Potash | 3.34 | 1.81 |
| Water | 1.73 | 0.33 |

*Structure.*—The rocks of this group are as a rule porphyritic with a holo-crystalline groundmass, though sometimes there is present a small amount of amorphous interstitial matter or base; at times amygdaloidal.

*Colors.*—The colors are dark, some shade of gray or brownish.

*Classification and nomenclature.*—According to their varying mineral composition Rosenbusch divides them into:

Leucite tephrite = Leucite, augite, plagioclase rocks.
Leucite basanite = Leucite, augite, plagioclase and olivine rocks.
Nepheline tephrite = Nepheline, plagioclase rocks.
Nepheline basanite = Nepheline, plagioclase and olivine rocks.

The rocks it will be observed stand intermediate between the true basalts and the nephelinites to be noted later. The distribution of these rocks is, so far as now known, quite limited.

The following localities and varieties are represented:

*Leucite tephrite:* Tovalato, near Rome, Italy, 35752.

*Leucite basanite:* Bosco Reale, Vesuvius, flow of 1751, 36542; Il Granatello, Vesuvius, flow of 1631, 36544; La Scala, Vesuvius, flow of 1631, 36547; Uncino, Vesuvius, flow of 1760, 36545; Cisterna, Monte Somma, 38738 and 38789; Vesuvius flow of 1855, 36546; do., flow of 1872, 36144; Vesuvius, 35724.

*Nepheline tephrite:* Kleine Priessen, Bohemia, 36534 and 36535; Kostal, Bohemia, 36536; Calvarienberg, Poppenhausen, Rhon Mountains, 36532, 70227, and 70228; Langenscheid, Nassau, Germany, 36537; Niedermendig, Prussia (with Hauyn), 34686; Tavolato, Rome, Italy, 36539; Rocco Monfina, Rome, Italy, 36540; Serra de Tingua, Brazil, 70255.

*Nepheline basanite:* Hundkoph, Salzungen, Germany, 70229; Stallberg, Rhon Mountains, Germany, 70230; near Rossdorf, Germany, 70231 and 70238; near Weiler, Baden, 35859; Lobau, Saxony, 73116, 73117, and 73118.

### 11. The picrite porphyrites.

Under this head is placed, by Professor Rosenbusch, a small group of rocks so far as now known, very limited in their distribution, and which are regarded as the effusive forms of the plutonic picrites, as bearing the same relation to these rocks as do the melaphyrs to the olivine diabases. The essential constituents are therefore olivine and augite with accessory apatite, iron ores and other minerals mentioned as occurring in the true picrites. Structurally they differ from these rocks in presenting an amorphous base rather than being crystalline throughout. These rocks are supposed to have an important bearing on the origin of the diamond, the diamond bearing rocks of South Africa having been found to be picrite porphyrite (Kimberlite, see specimen No. 73190 from the De Beers mine) cutting highly carbonaceous shales. An examination of the Kentucky peridotite locality, where the rock occurs under quite similar conditions, failed to show that similar results had been there produced, a fact which is supposed to be due in part to the small amount of carbonaceous matter in the surrounding shales.

The group is very limited, and is represented in the collection only by samples from Elliott County, Kentucky (38603 and 38360); Pike County, Arkansas, (72792); Syracuse, Onondaga County, New York (35721 and 70556), and the De Beers diamond mine at Kimberly, South Africa (73190).

### 12. THE LIMBURGITE AND AUGITITE GROUP.

Limburgite, a name given by Rosenbusch in 1872 to designate this type of rocks as occurring at Limburg, on the Kaiserstuhl in the Rhine. The name Augitite given, since augite is the essential constituent.

These are small groups of eruptive rocks consisting essentially of the mineral augite, with iron ores, and having a glassy base. Olivine is present in the variety Limburgite. The common accessories are the same as those of the basalts. Structurally the rocks so far as known are never holocrystalline, but glassy and porphyritic. They are divided into the olivine-bearing variety limburgite, and the olivine-free variety augitite. The composition of (I), a limburgite from Rhenish Prussia, and (II), an augitite from the Cape Verde Islands, as given by Roth, is as follows:

| | I. | II. |
|---|---|---|
| | *Per cent.* | *Per cent.* |
| Silica | 42.24 | 41.[illegible] |
| Alumina | 8.66 | 18.6[illegible] |
| Iron sesquioxide | 7.45 | 16.1[illegible] |
| Magnesia | 12.27 | 4.[illegible] |
| Lime | 11.76 | 11.[illegible] |
| Soda | 4.02 | 4.7[illegible] |
| Potash | 1.08 | 2.4[illegible] |
| Water | 3.71 | [illegible] |

These rocks are of very limited distribution and at present quite unknown within the limits of North America. The group is represented in the collections as follows:

*Limburgites:* Limburg ruin on the Kaiserstuhl, near Sasbach, Baden, 34718 and 36589; Hasenberg, Bohemia, 36588; near Xiririca, Prov. de Sao Paulo, Brazil, 69992; Nova Laraugerras, Prov. de Rio Janeiro, Brazil, 69991.

*Augitite:* Province de Rio Janeiro, Brazil, 69995; Paschkapole, Bohemia, 36590.

### 13. THE LEUCITE ROCKS.

*Mineral composition.*—The essential constituent is leucite and a basic augite. A variety of accessories occur, including biotite, hornblende, iron ores, apatite, olivine, plagioclase, nepheline, melilite, and more rarely garnets, hauyn, sphene, chromite, and perowskite. Feldspar as an essential fails entirely.

*Chemical composition.*—The average chemical composition as given by Blaas* is as follows: Silica, 48.9; alumina, 19.5; iron oxides, 9.2; lime, 8.9; magnesia, 1.9; potash, 6.5; soda, 4.4 per cent.

*Structure.*—The rocks of this group are, as a rule, fine-grained and often slightly vesicular, presenting to the unaided eye little to distinguish them from the finer grained varieties of ordinary basalt.

*Colors.*—The prevailing colors are some shades of gray, though sometimes yellowish or brownish.

*Classification and nomenclature.*—The varietal distinctions are based upon the presence or absence of the mineral olivine and upon structural grounds and various minor characteristics. We have the olivine free variety *Leucitite* and the olivine holding variety *Leucite basalt.*

These rocks have also a very limited distribution, and so far as known are found within the limits of the United States only at the Leucite Hills, Wyoming (specimens 36877 and 72846).

The localities now represented are as follows:

*Leucitite:* The following localities in the province of Rome, Italy: Capo di Bove, 36560; Aqua acetosa, via Laurentia, 36561; Bagnorea, 36562; Cava di Marino, 36673; Fontana di Papa, Strada d'Albano, 36564; Sta Maria di Galera Bracciano, 36565; Mte. Salumone, Mte. Compatri, 36566; Villa Lancellotti, Frascati, 36567; Colle del Eremita, Mte. Compatri, 36568; Cima del Tuscolo, 36569; Colle dei Cypressi, Mte. Compatri, 36570; Italy, 70232; near Conca, Roccamonfina, Italy, 73020; Serra des Pocos di Caldos, province de la Sao Paulo, Brazil, 69985; N. W. of Points of Rocks, Leucite Hills, Wyoming, 36877 and 72846.

*Leucite basalt.*—Laacher See, Prussia (with rubelan), 36571; Diefelderstein, Kungskopf, Bausenberg, and Veitskopf, Laacher See, Prussia, 36571 to 36575, inclusive; Pohleberg, near Annaberg in the Erz-Gebirge, Saxony, 36576.

### 14. THE NEPHELINE ROCKS.

*Mineral composition.*—These rocks consist essentially of nepheline with a basaltic augite and accessory sanidin, plagioclase, mica, olivine, leucite, minerals of the sodalite group, magnetite, apatite, perowskite, and melanite.

*Chemical composition.*—Below is given the composition of (I) a nephelinite from the Cape Verde Islands, and (II) a nepheline basalt from the Vogelsberg, Prussia.†

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* Katechismus der Petrographie, p. 117.

† Roth's Gesteine Analysen, 1884.

| | I. | II. |
|---|---|---|
| | *Per cent.* | *Per cent.* |
| Silica | 46.95 | 42.37 |
| Alumina | 21.59 | 8.86 |
| Iron sesquioxide | 8.09 | 11.26 |
| Iron protoxide | .......... | 7.80 |
| Magnesia | 2.49 | 13.01 |
| Lime | 7.97 | 10.93 |
| Soda | 8.93 | 4.51 |
| Potash | 2.04 | 1.21 |
| Water | 2.09 | 0.34 |
| Specific gravity | .......... | 3.163 |

*Colors.*—The prevailing colors are various shades of gray to nearly black.

*Structure.*—Structurally they are porphyritic with a holocrystalline or in part amorphous base, usually fine grained and compact, at times amygdaloidal.

*Classification and nomenclature.*—These rocks differ from the basalts, which they otherwise greatly resemble, in that they bear the mineral nepheline in place of feldspar. Based upon the presence or absence of olivine we have, first, *Nephaline basalt*, and second, *Nephelinite.* The name *Nepheline dolerite* has been given in some cases to the coarser holocrystalline olivine-bearing varieties.

Like the leucite rocks the rocks of this group are somewhat limited in their distribution. They are at present represented in the collection as follows:

*Nephelinite:* Herchenberg and Hahnenbacher Ley, Rhenish Prussia, 36550 and 36551: Monte Vulture, near Melfi, Italy (Hauynophyr, so called because rich in the mineral Hauyn), 56552, 73012, and 73010; Neudorf, Saxony (Hauynbasalt), 36548.

*Nepheline basalt:* Near Weiler, Baden, 35861; Katzenbuckel, in the Odenwald, Baden, 36557 and 73040; Eppstein, in the Taunus Mountains, Germany, 36555: Rossberg, near Rossdorf, Hesse, Germany, 36558; Hydrotachylite in same, 36562: Spechtshausen, Saxony (transitional variety, near Limburgite), Loban, Saxony, 36553; Salzberg, near Schlan, Bohemia (noseanite of Boricky), 36549; Kletschner Borg, Bohemia, 36554; Scheibenberg, in the Erz-Geberge, 36559.

### 15. THE MELILITE ROCKS.

Professor Rosenbusch places under this head a small group of rocks heretofore known as melilite basalts, in which the mineral melilite is the chief constituent, with accessory augite, olivine, nepheline, biotite magnetite, perowskite, and spinell. The normal structure is holocrystalline porphyritic, in which the olivine, augite, mica, or occasionally the melilite, appear as porphyritic constituents.

These are rocks of very limited distribution, and at present represented in the Museum collections only by specimens from Wartenberg, Bohemia, and from near Owen, in Wurtemberg (35860 and 36577.)

# APPENDIX.

Aside from the collections described above as forming the exhibition series, as illustrative of the mineral aggregates forming any appreciable proportions of the earth's crust, there are in the department, stored away in the table cases, many collections designed primarily for study. These are so arranged as to be accessible to the student on application to the Director of the Museum, and on presentation of proper credentials if such be deemed necessary. The collections thus stored are classed under the head of the study series. In preparing and arranging this series it may be well to state that it is made up largely of such materials as have somewhere and at some time been subject to investigation. Each specimen, after trimming to a size approximating 3 by 4 by 1 inch, has a number painted on it in oil colors, and which refers to a written catalogue in which is given whatever detailed information regarding its source and nature may be in possession of the department. The specimen is then placed in a pasteboard tray, accompanied by a written label containing the same information as given in the catalogue, and placed in the drawers of the table cases. Material which is designed for the study series is, if of a miscellaneous nature, distributed through the collections in a systematic manner, corresponding to that adopted for the exhibition series. Collections which like those from Leadville and the Eureka district, to be noted later, represent systematic work upon rocks of a definite area, or which have been studied as a group for the elucidation of some particular problem, are kept intact in order to best serve the purposes of the investigator. Characteristic rocks have in some cases been selected from these collections for exhibition purposes, but the individuality of the collection is in no case allowed to become destroyed.

The more important collections in this study series are mentioned below:

(1.) *Systematic study series.*—This collection comprises some 3,000 specimens miscellaneous rocks from all parts of the globe classified systematically as in the exhibition series.

(2.) *The Leadville collection.*—This comprises some 380 eruptive, sedimentary and metamorphic rocks and ores as collected and studied by Messrs. S. F. Emmons and C. Whitman Cross, of the U. S. Geological Survey, from the vicinity of Leadville, Colorado. It is a representative collection of the materials described by the above-named authorities in Monograph XII of the U. S. Geological Survey, J. W. Powell Director, and entitled "Geology and Mining Industries of Leadville." A characteristic series of the rocks and ores has been selected out and placed upon exhibition in the section devoted to economic geology (catalogue Nos. 68801–69540, inclusive).

(3.) *The Washoe collections.*—These collections represent the work done by G. F. Becker and colleagues in the Washoe district and Comstock

Lode, Nevada, the results of which were published in Monograph III of the U. S. Geological Survey, entitled "The Geology of the Comstock Lode." They have also been the subject of investigation by Messrs. Hague and Iddings, of the Geological Survey, whose results are embodied in Bulletin No. 7, U. S. Geological Survey, 1885, entitled "The Development of Crystallization in the Igneous Rocks of Washoe, Nevada."

The collection is in part duplicated. There is, first, a series of 198 specimens typical rocks of the region in sizes some 4 by 5 by 1 inches and which is in part upon exhibition. Besides this is the main study series in sizes about 1½ by 1 by ½ inches and comprising 2,064 specimens. (Catalogue Nos. 24001–24198 inclusive, and 70691–72754 inclusive).

(4) *The collections of the fortieth Parallel Survey.*—This comprises some 3,000 specimens eruptive and sedimentary rocks collected by members of the Fortieth Parallel Survey, under the direction of Clarence King in 1867–'73. The eruptive rocks of the series were described by Prof. F. Zirkel in vol. VI (microscopic petrography) of the reports of the U. S. Geological Explorations of the Fortieth Parallel. (Catalogue Nos. 20301 to 23388, inclusive.)

(5) *New Hampshire State Survey, C. H. Hitchcock in charge.*—A collection in the form of rough hand specimens, some 6 by 6 by 1½ inches in dimensions and representing the typical rocks of New Hampshire as described by Hitchcock and Hawes in the reports of the Geological Survey of New Hampshire.

(6) *The Hawes collections.*—These comprise some 350 specimens eruptive and altered rocks, representing in part the work done by Dr. Hawes in connection with the New Hampshire surveys as published in part IV, vol. III, of these reports. It also includes the small fragments described in his paper as the Albany granites and their contact phenomena (Am. Jour. of Science, 1881, XXI, p. 21–32), Cat. Nos. 29628–29290.

(7) *The Pacific Slope quicksilver collections.*—These comprise several hundred small specimens (mostly 4 x 6 cm) rocks and ores from the quicksilver regions of the locality above noted, as collected and described by G. F. Becker and colleagues in Monograph XIII, of the U. S. Geological Survey, entitled Geology of the Quicksilver Deposits of the Pacific Slope.

(8) *U. S. Geological Survey collections, F. V. Hayden in charge.*—The various collections made by the surveys under the direction of F. V. Hayden, mainly from Colorado, New Mexico, Utah, Montana, Wyoming, Idaho, and the Yellowstone National Park. These comprise some 1,200 hand specimens of eruptive and sedimentary rocks. Much valuable material is missing from these, having been lost or destroyed prior to 1880.

(9) *Collections from surveys west of the one hundredth meridian.*—The collections made in 1871–'79 under the direction of Lieut. G. M.

Wheeler, U. S. Engineer Department. These comprise some 680 specimens which, though but little studied by modern methods, are, together with those of the Hayden surveys, kept together for purpose of reference.

(10) *Canadian geological survey.*—A stratigraphic series comprising some 854 hand specimens of rocks from the various geological horizons of Ontario, Quebec, New Brunswick, and Nova Scotia, received from the Canadian authorities at the close of the Centennial Exposition at Philadelphia in 1876.

(11) *Pigeon Point collection.*—This comprises 400 specimens illustrating various contact phenomena, as occurring at Pigeon Point on the north shore of Lake Superior, and as described by Prof. W. S. Bailey in a forthcoming bulletin of the U. S. Geological Survey.

(12) *Menominee Valley and Marquette River collections.*—These comprise 254 specimens illustrative of the dynamic metamorphism of eruptive rocks as described by Dr. G. H. Williams in Bull. No. 62, U. S. Geological Survey.

(13) *Alaska collections.*—These comprise some 250 specimens miscellaneous rocks collected mainly by W. H. Dall in 1866–68.

(14) *Missouri.*—A series comprising 114 characteristic rocks from southwestern Missouri, as collected and described by Prof. E. Haworth. (Catalogue Nos. 38618–38741, inclusive.)

(15) *Bear Paw Mountains, Montana.*—A small series eruptive, metamorphic, and drift rocks from the Bear Paw Mountains, collected by Dr. A. C. White and J. B. Marcou in 1883. (Catalogue Nos. 28666–28743, inclusive.)

(16) *St. Gothard Tunnel.*—A series of metamorphic rocks, comprising some 81 specimens received from the Swiss Commissioner to the Centennial Exposition at Philadelphia in 1876. (Catalogue Nos. 37495–37574.)

(17) *Commander Islands, coast of Kamschatka.*—A small series of the characteristic rocks of these islands, collected by Dr. L. Stejniger in 1882–'83. (Catalogue Nos. 37937–37972.)

(18) *Australian collections.*—A series of some 355 rocks from Victoria, Australia, as received from the Australian centennial commissioners in 1876. (Catalogue Nos. 28121–28475, inclusive.)

(19) *Brazilian collections.*—An interesting series of 266 specimens eruptive and metamorphic rocks received from the governmental geologist, O. A. Derby. (Cat. Nos. 69759–70027.)

(20) *District of Columbia collections.*—This includes a series of several hundred specimens, collected mainly by Prof. Thomas Robinson at intervals of every fifty feet in the tunnel of the Washington Acqueduct extension.

To the extent that facilities have permitted, sections for microscopic study have been prepared from the rocks of both the exhibition and study collections. At the date of writing, the number of these slides amounts to some 4,000. Of these, 2,700 are of rocks in the building-stone collections, and which were prepared in large part under the direction of Dr. G. W. Hawes.

# THE CATLIN COLLECTION OF INDIAN PAINTINGS.*

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By WASHINGTON MATTHEWS, M. D., LL. D., *Major and Surgeon, U. S. Army.*

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The majority of my audience have, no doubt, been many times in this hall, either as attendants on the lectures which are delivered here, or as visitors to the Museum, and many times they have gazed on the array of paintings which cover its walls. To what extent have they observed these? What lessons have they learned from them? What opinions have they formed, what criticisms have they made of them? What do they know of their history or of the history of the wandering artist whose busy hand painted them? These are questions to which I can frame only imperfect answers. I have asked such questions of many who have visited this Museum, and I am led to believe that not more than one in ten bestows an inquiring glance at this monument to a life of laborious and enthusiastic devotion to a chosen subject; and vastly fewer are those who inquire into the nature and scope of the collection, or stop to discover the name and something of the personality of the author.

George Catlin was, to use his own expression, a lion in his day. He enacted in Europe fifty years ago much the same rôle that "Buffalo Bill" has played in our time, but in a more scholarly and less lucrative way. He was the genial showman of the American Indian and the wild West. He carried his collection—the very collection we see around us now—o various European capitals. He exhibited live Indians, and he and is protégés were received and entertained at the homes of English obility. They dined with Louis Phillippe and with the King and Queen of Belgium. The following brief autobiography is taken from is work entitled "Illustrations of the Manners, Customs, and Condiion of the North American Indians."

> "I was born in Wyoming, in North America, some thirty or forty years since (*i. e.*, *1796*), of parents who entered that beautiful and famed valley soon after the close the revolutionary war, and the disastrous event of the "Indian massacre."
>
> "The early period of my life was whiled away, apparently somewhat in vain, with oks reluctantly held in one hand and a rifle or fishing pole firmly and affection- ely grasped in the other.
>
> "At the urgent request of my father, who was a practicing lawyer, I was prevailed on to abandon these favorite themes and also my occasional dabblings with the

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* Reprint of a lecture delivered in the lecture hall of the National Museum, Satur- y, April 13, 1889.

brush, which had secured already a corner in my affections, and I commenced reading the law for a profession under the direction of Reeve and Gould, of Connecticut. I attended the lectures of these learned judges for two years—was admitted to the bar—and practiced the law as a sort of *Nimrodical* lawyer, in my native land, for the term of two or three years; when I very deliberately sold my law library and all (save my rifle and fishing tackle), and converting their proceeds into brushes and paint pots, I commenced the art of painting in Philadelphia, without teacher or adviser.

"I there closely applied my hand to the labors of the art for several years; during which time my mind was continually reaching for some branch or enterprise of the art on which to devote a whole lifetime of enthusiasm; when a delegation of some ten or fifteen noble and dignified-looking Indians, from the wilds of the "Far West," suddenly arrived in the city, arrayed and equipped in all their classic beauty,—with shield and helmet,—with tunic and manteau,—tinted and tasseled off, exactly for the painter's palette!

"In silent and stoic dignity these lords of the forest strutted about the city for a few days, wrapped in their pictured robes, with their brows plumed with the quills of the war eagle, attracting the gaze and the admiration of all who beheld them. After this, they took their leave for Washington City, and I was left to reflect and regret, which I did long and deeply, until I came to the following deductions and conclusions:

"Black and blue cloth and civilization are destined, not only to veil, but to obliterate the grace and beauty of Nature. Man, in the simplicity and loftiness of his nature, unrestrained and unfettered by disguises of art, is surely the most beautiful model for the painter,—and the country from which he hails is unquestionably the best study or school of the arts in the world: such, I am sure, from the models I have seen, is the wilderness of North America. And the history and customs of such a people, preserved by pictorial illustrations, are themes worthy the lifetime of one man, and nothing short of the loss of my life, shall prevent me from visiting their country, and of becoming their historian.

"There was something inexpressibly delightful in the above resolve, which was to bring me amidst living models for my brush: and at the same time to place in my hands again, for my living and protection, the objects of my heart, above named, which had long been laid by to rust and decay in the city, without the remotest prospect of again contributing to my amusement.

"I had fully resolved—I had opened my views to my friends and relations, but got not one advocate or abettor. I tried fairly and faithfully, but it was in vain to reason with those whose anxieties were ready to fabricate every difficulty and danger that could be imagined, without being able to understand or appreciate the extent or importance of my designs, and I broke from them all,—from my wife and my aged parents,—myself my only adviser and protector."

Such is Catlin's own rather flowery account of how he formed his resolution; but the language in which he expresses it is only an evidence of the reality of his enthusiasm.

These paintings as works of art I now often hear unfavorably criticised; but criticism is an easy task for those who do not appreciate the difficulties under which Catlin labored. To-day our land is filled with artists of both sexes, of all ages, and of every degree of fitness and unfitness. The number of amateur aspirants in art has increased a hundred fold in the last half century.

To accommodate this growth of artistic demand, the conveniences and appliances of art have improved and increased. The well equipped sketcher in oil of to-day can not appreciate the difficulties of the traveling artist in America fifty or sixty years ago. There were then no pa sketching boxes, with their complication of conveniences. The compressible metallic tube had not been invented, or at least not introduced into the armamentarium of art. Not one-fourth of the present tints of Winsor and Newton's catalogue were then known. Rapidly drying vehicles were not in vogue. The artist ground his own paints—coarse, crude paints—and carried them around mixed in pots or dry in paper. I do not think that a careful analysis of Catlin's paintings will reveal more than a dozen pigments; I have reference to the paintings which were taken, so to speak, on the wing. He had not accommodations for more. While collecting a large number of these views, he was traveling with two other men in a small canoe, which, in addition to his paints and canvas, held their clothing, bedding, ammunition and provisions; in fact, everything necessary for life and comfort in a land inhabited only by savages. Ethnographic travelers of to-day, with pocket camera and instantaneous dry-plates, have a vast advantage over Catlin with his red lead—which he used liberally—his boiled oil and his rolled canvas; but their results are not correspondingly more accurate. Many of his sketches, too, were necessarily taken in great haste. Yet he never failed to catch the spirit of the scene before him and to transfer it faithfully to his canvas. But, while making all just excuses for Catlin, it must be acknowledged that he was not acquainted with all the resources of his art as it existed even in his day. He was a self-taught man.

From my own experience, following, as I have done for years, in the very trail of Catlin, I can not speak too highly of his general truthfulness; yet he suffered from certain limitations of his time and surroundings which have impaired the usefulness of his literary work. Without telling any direct falsehood, he succeeds sometimes in deceiving the reader. His books must be read critically; they are not of equal use to all students. In this year of our Lord there are so many workers in all specialties, and the facilities for publication in each are so great, that one may write on the driest and most technical subjects, in the least interesting manner, and yet be reasonably certain of finding a publisher and a coterie of readers. It was not thus in America fifty years ago, and Catlin, who was a poor man, in order to make his enterprise pay, had to write for a general public, whom he felt obliged to interest as well as instruct. He sometimes painted also with this intent, as will be shown later. Indeed, he thus candidly criticises himself in one of his letters:

> "It would be impossible at the same time, in a book of these dimensions, to explain *all* the manners and customs of these people; but as far as they are narrated, they have been described by my pen, upon the spot, as I have seen them transacted; and if some few of my narrations should seem a *little too highly colored*, I trust the world will be ready to extend to me that pardon which it is customary to yield to all artists whose main faults exist in the vividness of their coloring rather than in the drawing of their pictures; but there is nothing else in them, I think, that I should ask pardon for, even though some of them should stagger credulity and incur for me the censure of critics."

But the question of too high coloring is often one of personal equation only. One of our greatest modern writers thus defends himself against the charge of exaggeration:

> "What is exaggeration to one class of minds and perception is plain truth to another. That which is commonly called long-sight, perceives in a prospect innumerable features and bearings non-existent to a short-sighted person. I sometimes ask myself whether there may occasionally be a difference of this kind between some writers and some readers; whether it *is always* the writer who colors highly or whether it is now and then the reader whose eye for color is a little dull."

Half a century ago the country west of the Mississippi was a veritable *terra incognita.* No one appreciated the magnificent distances of that region. The Rocky Mountains were supposed to be somewhat in sight of the falls of St. Anthony. I remember once seeing in a novel written by an author who, I believe, is still living, an account in which the hero is represented as ascending to the roof of a one-story structure on the banks of the Illinois River, and looking admiringly over an extensive landscape which was "bounded on the west by the distant outline of the Rocky Mountains." In other words, this gentleman of telescopic eye was able to take in the entire states of Missouri and Kansas and half of Colorado at a single glance. With such ideas prevailing among the learned, how could Catlin, having journeyed some three thousand miles up the Missouri, come back with his finger in his mouth and say he had not had a glimpse of the Rocky Mountains? No one would believe him. He must at least pretend he had seen them, and so by an ingenious verbal fabrication,[*] but without the slightest direct falsehood, he makes possible the inference that he saw their snowy summits during his journey up the Missouri River in 1832. So well does he succeed that a recent student of Catlin, in a published map, terminates the itinerary of 1832 some hundreds of miles west of the mouth of the Yellowstone, which latter was really his farthest west during the year in question.

I have not time now to explain in full my reasons for knowing that Catlin did not see the Rocky Mountains in 1832, as he leads many to suppose he has done; but if there is any one in the audience conversant with Catlin's works, who wishes to have the proofs on this point, I am at his service. Not only did Catlin not see the "Rockies" in 1832, but I have serious doubt if he saw the main chain at any time during the eight years or more during which he was engaged in making this Gallery. What he may have seen and sketched after 1852, when the Gallery passed into other hands, I do not know; but then the California gold fields had been discovered, the overland route was trodden as clear as a thrashing-floor, and the visit to the Rocky Mountains had become a common achievement. One of the reasons for my doubts is the evidence of the collection itself. Examine all these pictures carefully daylight, and you will see that the artist well appreciated the distinctive beauties of different landscapes—the odd, the peculiar, the striking. There is not a remarkable scene on the Upper Missouri from the Platte to the Yellowstone that he has not transferred to his canvas. To the beauties of the Upper Mississippi he has done a justice which Banvard did not excel. If he has worked so faithfully on these beautiful but comparatively tame landscapes, how would the infinitely grander scenes of the Rocky Mountains have inspired him? Could he have held his brush still in sight of them? Yet no view of that vast mountain region is to be found in his collection, with the possible exception of some ridges seen from the Comanche camp in 1834, which may have been outlying spurs of the Sierra Madre. Pike's Tent, an odd and beautiful but comparatively insignificant bluff, some five hundred feet high, on the upper Mississippi, has a canvas allotted to it in the Gallery, but for a view of Pike's Peak, fourteen thousand feet high and covered with eternal snows, we seek in vain. In vain do we search for a view of a single one of the monarchs of the Chippewyan Range.

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[*] See "Illustrations of the Manners, Customs and Condition of the North American Indians," by Geo. Catlin, vol. 1, London, 1866, pp. 63–65. The conversation with "Batiste" here given is fictitious.

As is well known, literature has always had its requirements, which varied according to time, race and country. But, as is not so generally recognized, science too has had its requirements in times past, which limited and controlled its development. Perhaps it has its arbitrary and illogical requirements to-day, while we are not aware of them. The slave knows not how deeply the fetter has cut into his flesh until it has been cast away.

There was a singular demand made on the American ethnographer of a generation or two ago, and it has scarcely yet been silenced. He was obliged to advance a theory of an Old World origin for the American aborigines, and if not for the whole race, at least for that part of it in which he was most interested. The shelves of libraries of Americana are crowded with volumes devoted to proving such theories. Such an important place in the speculations of that time did these theories have, that a great religious system (a system which forms to-day one of the greatest political problems that confront us) is based upon the theory of the descent of the Indians from the ten lost tribes of Israel. We can understand Catlin's environment better, when we remember 7
that he lived in the time the angel Moroni revealed to Joseph Smith the hiding place of the golden tablets on which was engraved the book of Mormon.

Catlin's journey in 1832 on the Upper Missouri was his first important expedition, his first journey into a really wild land, as well as the most fruitful journey in artistic and ethnographic material that he ever made. His most interesting observations were taken among a sedentary, house-building, agricultural people named Mandans. Tribes of this class were not uncommon in America in his day, but at the time of his visit he was not aware of the fact. In the Mandan villages he found a hospitable and intelligent trader named Joseph Kipp, who proved himself a guide and interpreter of unusual value, and made the stay of his guest both pleasant and profitable. The latter arrived at the time of a most important rite of the Mandans, the whole of which he was permitted to witness and the like of which he never saw before or after. This rite I shall refer to at length before the close of the lecture. Mr. Kipp, too, undoubtedly spoke well of his Indian friends. I have often observed on the frontier that white men who have lived long with any particular tribe of Indians acquire a greater sense of loyalty to such tribe, that they hate its enemies, love its friends, sound its praises, and maintain its superiority to all other tribes. Had Catlin had opportunities of witnessing the great ceremonies of other nations under the conduct of guides as well informed as Mr. Kipp, he would not perhaps have considered the Mandans so superior to other tribes as he represents them in his writings. It was this people which he selected as the subject of his origin theory. By a series of arguments and conclusions which we would now call "jumping," but which passed muster in the science of half a century ago, he established to his own satisfaction that the Mandans were descended from certain Welshmen who sailed in ten ships under the direction of Prince Madoc from North Wales in the early part of the fourteenth century. Although his theory has little value in the light shed by modern investigation, it controlled all his opinions, distorted many of his statements, and has transmitted its evil influence through the works of a host of compilers and book-makers, many of them of high fame in the scientific world, down to the present day. So much for some of the unfavorable influences of his environment.

There are various portraits and pictures of our subject extant. One appears in his notes on Travel in Europe. Mr. Thomas Donaldson, in his recent work,* presents three, and in his own works the artist often includes sketches of himself. The plate facing page 701 in Donaldson's work is a copy of a picture painted by the artist's own hand when he was twenty-eight years old. He is represented by his contemporaries as a person of medium height, slender, well formed, very graceful, and of a complexion so decidedly dark that some of his friends thought he might possibly claim for his own, a little of the blood of that race to whose study he had devoted a life-time.

In Pl. CXXX is shown one of Catlin's sketches of himself in the prime of his activity and usefulness. It represents him in 1832, at the age of thirty-six, seated at a feast in the lodge of Mah-to-toh-pa or Four Bears, then second chief of the Mandans, dressed in his buckskin hunting suit. According to the etiquette of the place and time, he eats alone out of a wooden bowl, while his host fills the calumet for him to smoke after his meal, and the women of the household act the part of spectators.

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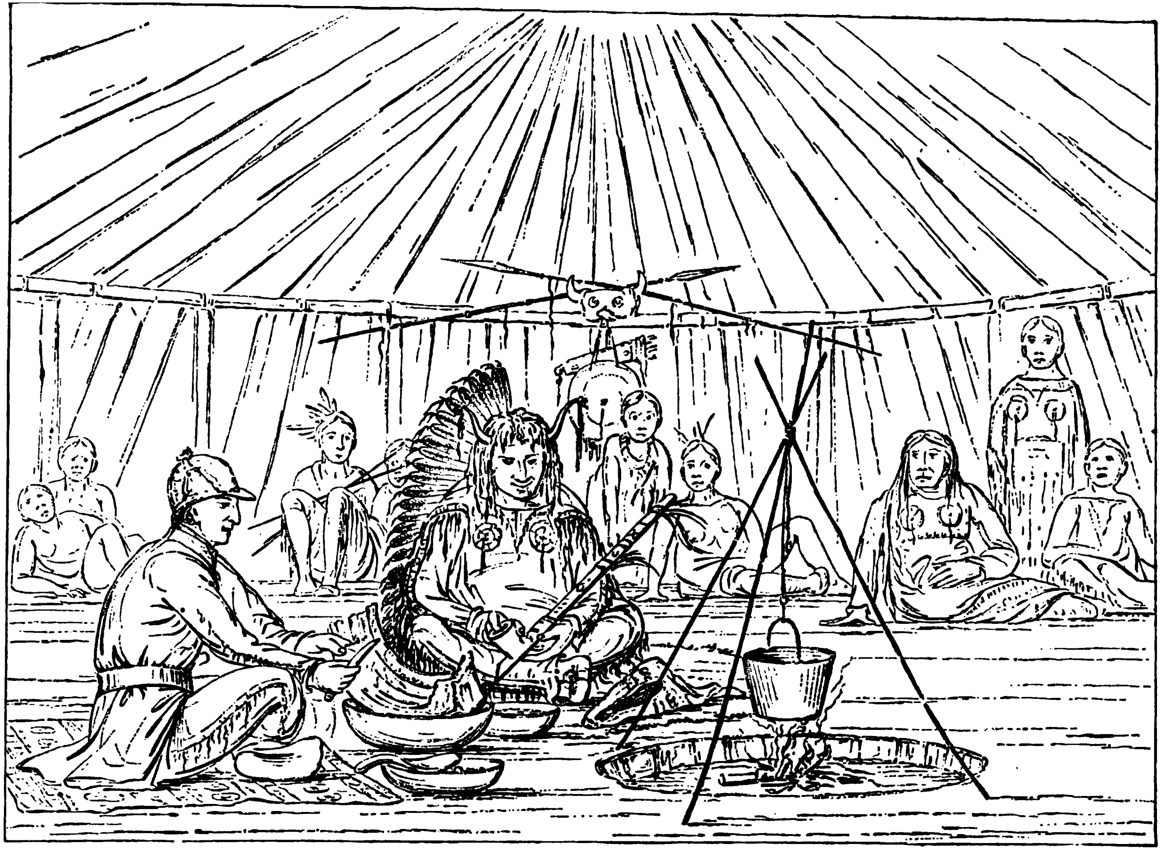
* "The George Catlin Indian Gallery in the U. S. National Museum (Smithsonian Institution), with Memoir and Statistics," in Smithsonian Report for 1885.



Catlin dining with Mah-to-toh-pa (Four Bears), Mandan Chief, July, 1832, at the Mandan Village, Upper Missouri.

(From Donaldson's "Catlin Indian Gallery," Plate 128.)

The plate facing page 711 in Donaldson's "Catlin Indian Gallery" is from a photograph taken in 1868, when he had reached the venerable age of seventy-two, about four years prior to his death. A scar on the left cheek, which shows in this picture, was caused accidentally by a hatchet stroke received in boyhood from a comrade with whom he was "playing Indian," an indication that the sight of the delegation in Philadelphia was not the first incident in his life which led to his vocation, although it may have been the decisive one.

Whatever unfavorable criticism may be made of Catlin as a colorist, little disparagement can be made of his accuracy and spirit as a delineator. In landscape he seizes the genius of the locality with marvelous quickness and insight. Any one who has traveled on the Upper Missouri will recognize how perfectly, in a few strokes, in the sketch before us (Pl. CXXXI, Fig. 1), he has fixed the features of that turbid flood, with its monotonous walls of cottonwood trees, terraced as they rise from the newer to the older alluvial deposits on its shores; with its caving bank, its falling trees and snags on the convexity of the river's curve where the current strikes the land with greatest force, and the low, shelving bank of the opposite side. It is not a placid stream; with a few well placed lines he tells us that it moves at the rate of seven miles an hour.

Geology, sixty years ago, was an infant science. The geologic landscape artist had not become differentiated from landscape artists in general—to this day but a limited few have obtained high proficiency among this class, yet I doubt if some of the best draftsmen attached to our own Government surveys could bring out more correctly the salient features of the soft Tertiary bluffs of the Dakota region than Mr. Catlin has done in the sketch represented in Pl. CXXXI, Fig. 2. Such is the country that is so appropriately designated *Mauvaises Terres*, or Bad Lands.

Pl. CXXXII, Fig. 1, copies his painting of a feature common in the bluffs of the Upper Missouri region, where small interrupted deposits of hard sandstone are mingled with much softer formations, not greatly exceeding ordinary clay in hardness. These pieces of sandstone, protecting the underlying soft rock from erosion by the rain, cause a series of pillars to be formed, as shown in the painting. A seam of lignite runs along the base of the bluff. The flood plain of the Missouri, here almost treeless, forms the distance.

The picture shown in Pl. CXXXII, Fig. 2, represents conical hills, which are very common in the same country. From these summits, during the rare rains of the region, streams of temporary existence flow with great force and cut deep, narrow, fantastic gulleys in the alluvial soil, such as that shown in the painting. These hills are striped horizontally in divers beautiful colors, being composed of strata of different tints to which the original canvas does ample justice.

Everywhere he has seized the distinctive features of the landscape and apparently with an intuitive understanding of its geologic basis. We need not marvel when we learn that in his later years, without any extensive book study, he became a good practical geologist. In this picture (Pl. CXXXIII, Fig. 1) he gives us a striking representation of the peculiar billowy hills which are so characteristic of the loëss deposits of the Missouri Valley in western Iowa and eastern Nebraska. These are the hills of loëss of 1832, with their smooth, grass-clad sides and their scanty groves in the ravines; such, too, they still seemed when last I saw them, fourteen years ago; but a change even then was coming over them; prairie fires were at an end and small shrubs were rising above the grass. These are perhaps good sized saplings to-day. So the forest will spread and soon the beautiful clear-cut outlines of these billowy slopes will no more have power to inspire the artist's hand.

In this, as in a hundred other cases, the pictures have, for us, a high historic value as fixing an irrevocable past. They show us landmarks of the West which have long ago disappeared, such as old trading posts of the Indian country; Fort Union, which stood forty years at the mouth of the Yellowstone, but the lines of whose foundation walls can scarcely be traced to-day.

Floyd's grave, the place of interment of the only man who died on Lewis and Clarke's famous expedition in 1804, is shown in Pl. CXXXIII. Fig. 2. Is there any trace of the once lonely mound now in the busy environs of Sioux City?* Does the pole still stand, as Catlin shows it, over Blackbird's grave (Pl. CXXXIV, Fig. 1), the last instance of a sepulchral mound built in historic times, showing that our modern Indians were mound builders? The self-reared monument of Julien Dubuque, the first white man who worked the Upper Mississippi lead-mines, a century ago, stood perfect still in Catlin's day, a stone hut with door of lead and cross of cedar (Pl. CXXXIV, Fig. 2); but, thirty-five years ago, I have seen it level with the ground. Such are some of the many obliterated land-marks reared by human hands that Catlin's pencil has perpetuated.

But works of nature, the landmarks erected by the eternal elements: can these be obliterated? Have they any past which the artist can preserve for the coming generations? Let this picture decide. Here are the falls of St. Anthony (Pl. CXXXV, Fig. 1), as they roared to an untenanted solitude in the year 1835, when George Catlin visited and sketched them. Who would recognize any identity between that fair wild scene and the falls of St. Anthony of to-day (Pl. CXXXV, Fig 2).

A very large proportion of the paintings in this collection is devoted to Indian games and hunting scenes (Pl. CXXXVI, Fig. 1), and these represent from a scientific point of view the most valuable part of the whole collection, with the exception of the four scenes of the great Mandan

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*Since this was written I have learned that (the grave being endangered by the gradual falling away of the edge of the bluff) the people of Sioux City have recently removed the remains of Sergeant Floyd further back from the river on the same hill.

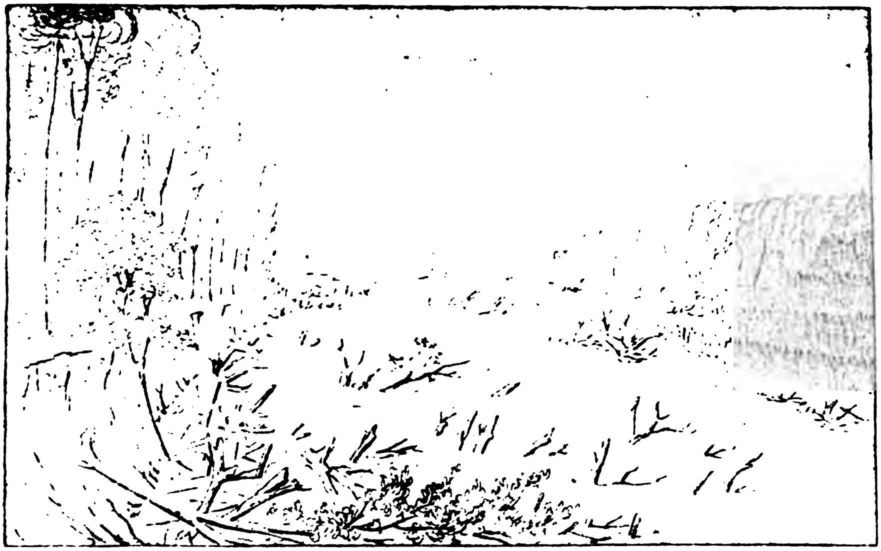


FIG. 1. SCENE ON THE UPPER MISSOURI.

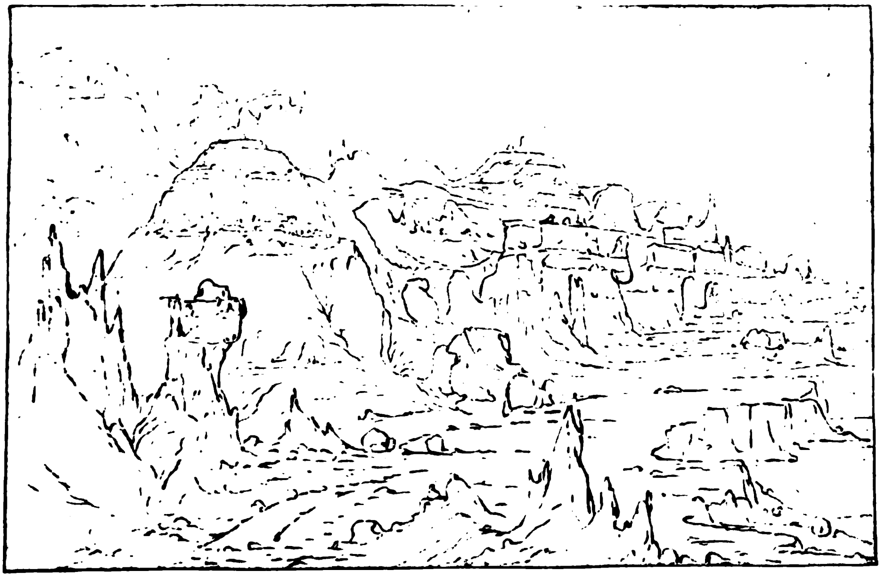


FIG. 2. BAD LANDS ON THE UPPER MISSOURI.

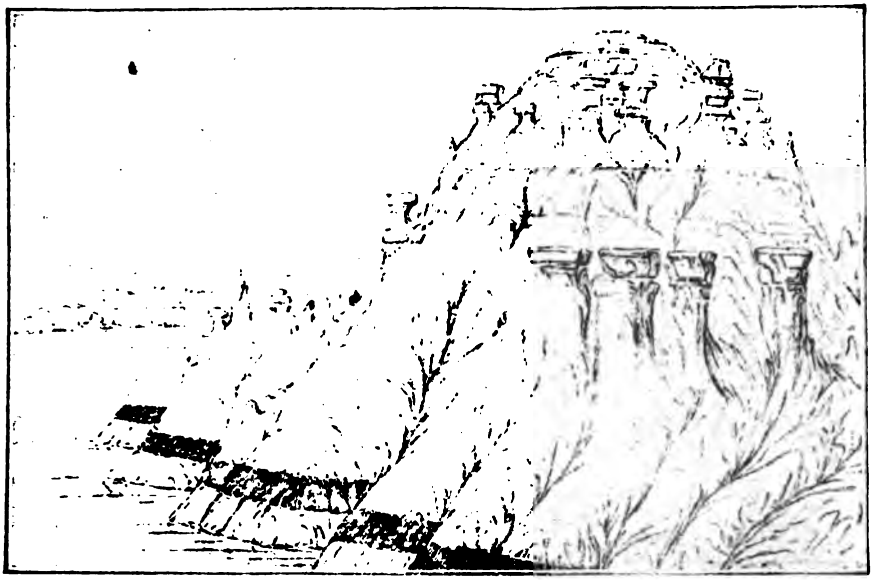


FIG. 1. BLUFFS ON THE UPPER MISSOURI.

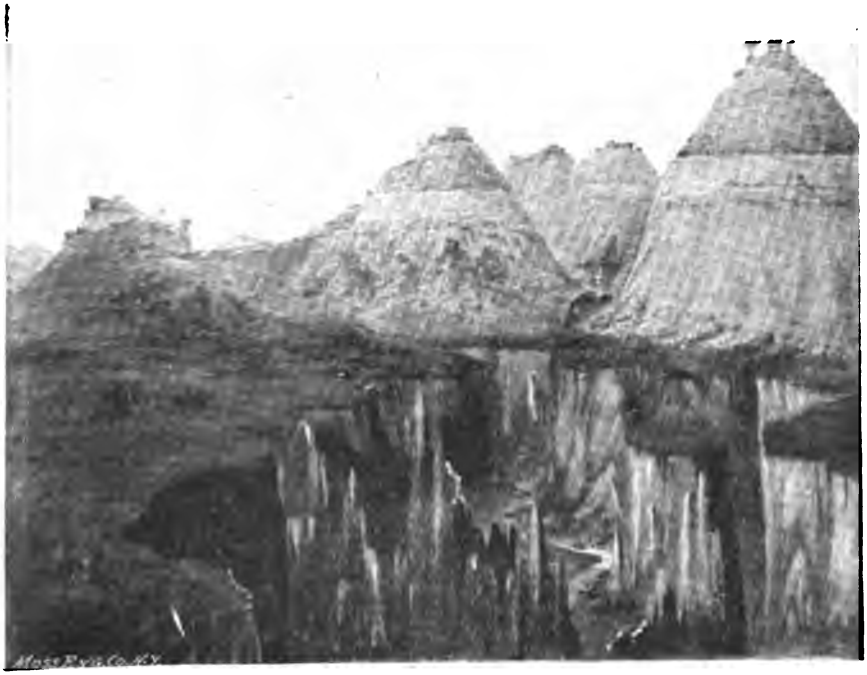


FIG. 2. SCENE ON BANKS OF THE UPPER MISSOURI.

FIG. 1. HILLS OF THE LOËSS, UPPER MISSOURI.

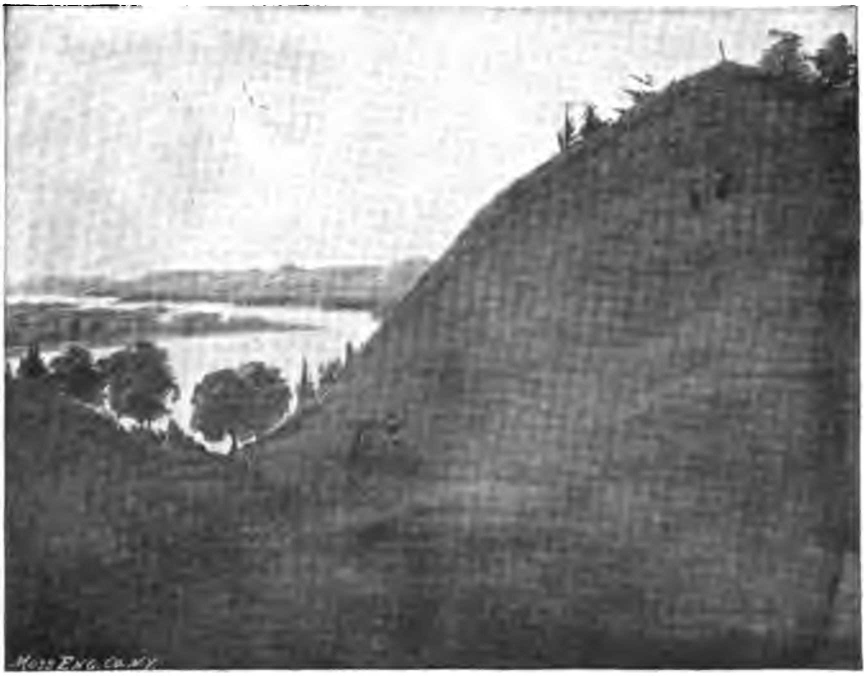

MOSS ENG. CO. N.Y.

FIG. 2. FLOYD'S GRAVE.

PLATE CXXXIV.

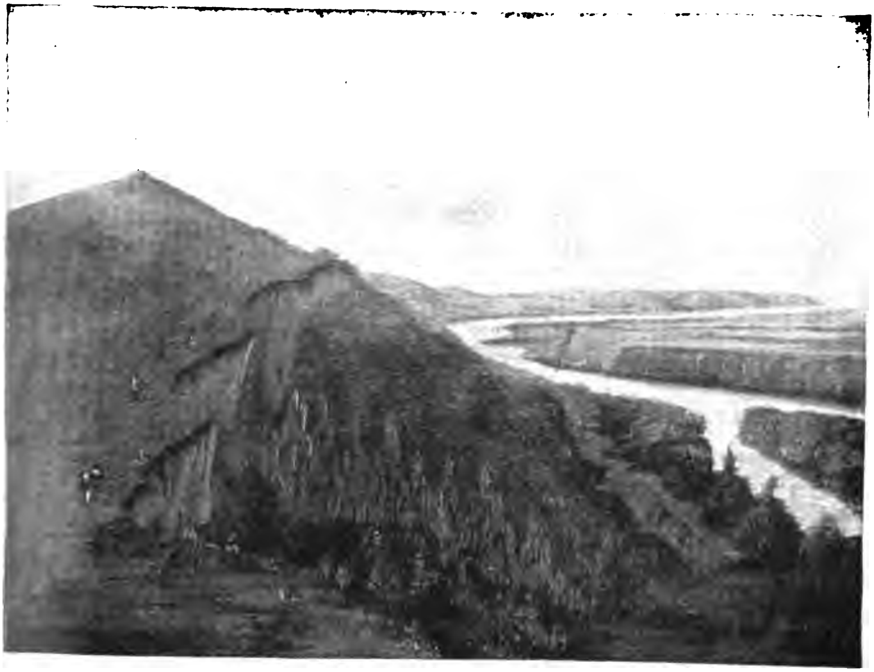


FIG. 1. BLACKBIRD'S GRAVE.

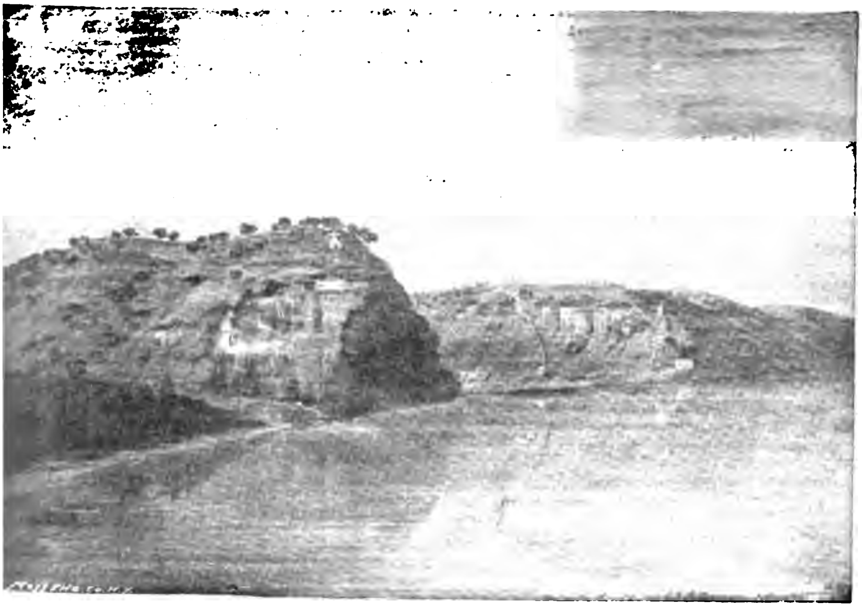


FIG. 2. DUBUQUE'S GRAVE.

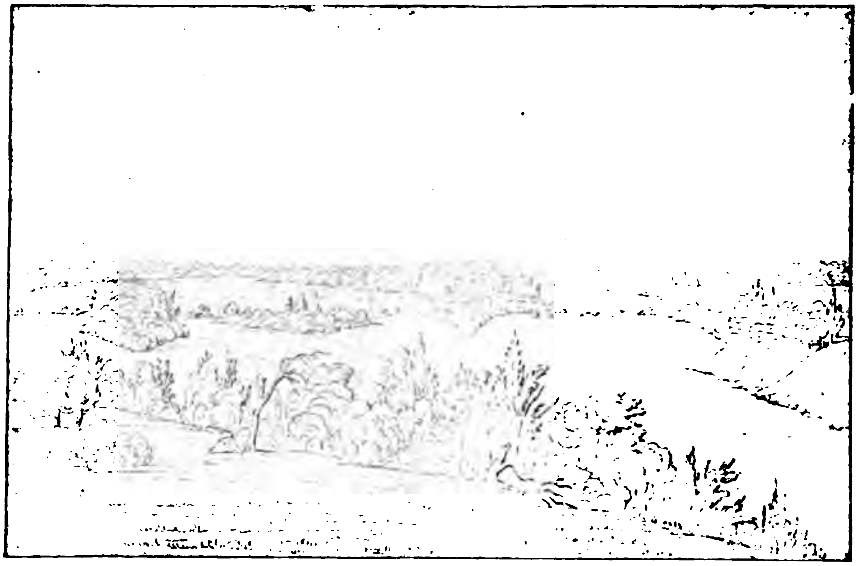


FIG. 1. FALLS OF ST. ANTHONY IN 1835.

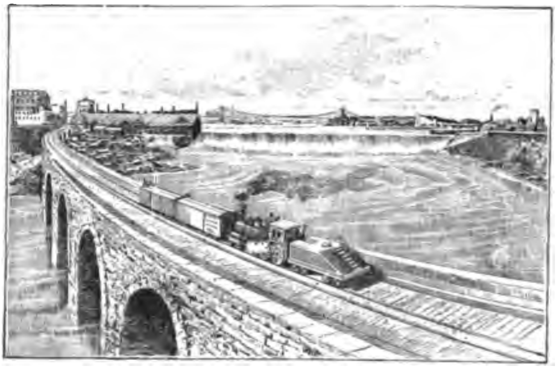


FIG. 2. MODERN FALLS OF ST. ANTHONY.

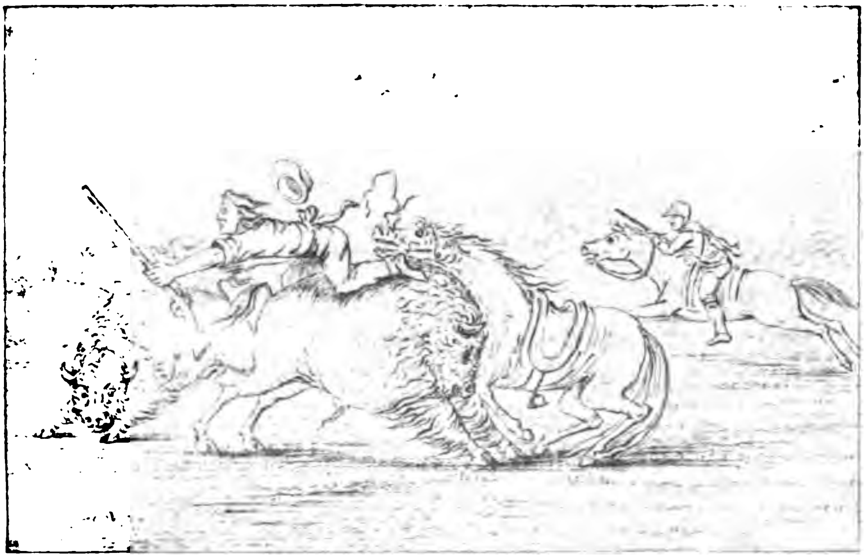


FIG. 1. BUFFALO HUNT ON HORSEBACK.

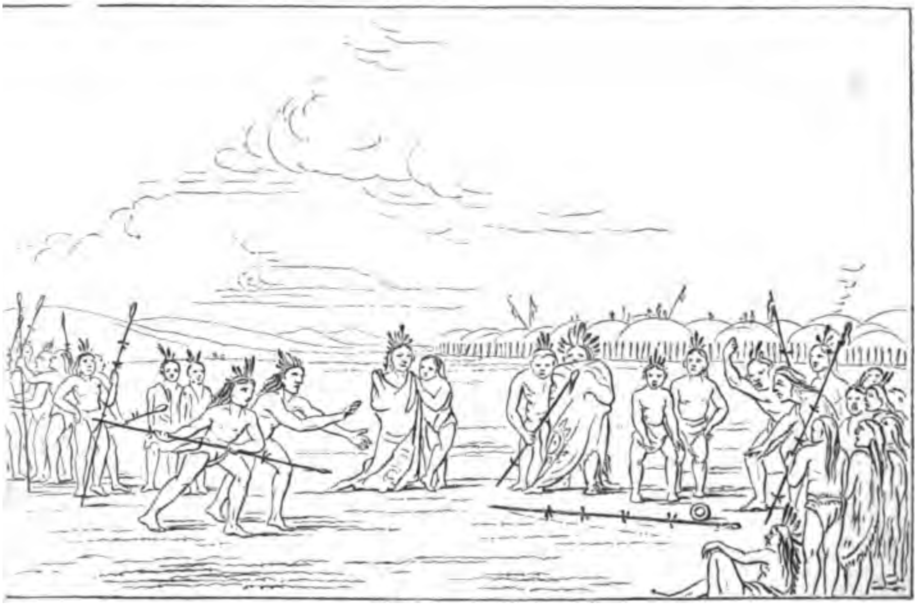


FIG. 2. MANDAN GAME OF TCHUNG-KEE.
(From Donaldson's "Catlin Indian Gallery," Plate 74.)

ceremony to be hereafter described. The scene in Pl. CXXXVI, Fig. 2, is presented, not because it is the most picturesque of this class that he has painted, but because, simple as it is, he has caught the spirit of the situation so well. The pose of the men who are betting on the game and watching anxiously the fall of the hoop is excellent. I have heard many favorable comments made on this plate by Indians. This game of Tchung-kee was, with some modifications, practiced over the greater part of North America at the time of the discovery and until long after.

Catlin devotes four canvasses to illustrating the exciting ball game of the Choctaws. One of his illustrations is shown in Pl. CXXXVII. He tells us that it is impossible with pen and ink alone, or brush, or even with their combined efforts to give more than a caricature of such a scene. However true this remark may be it is not to be denied that he here presents to us an unusually lively spectacle.

But the great temptation to present more illustrations of Indian games, some of which I have had the good fortune to witness, must be resisted.

The majority of his hunting scenes represent an irreclaimable past, since they are largely associated with an animal practically extinct, the American bison or buffalo. Catlin had the true spirit of the hunter; he was an excellent rider, a good shot, and for these reasons he delighted in painting hunting scenes, and he infuses more life into such studies than into any others which he executed. Pl. CXXXVIII, represents the destruction of a small band of buffalo which he witnessed near the Mandan villages. His pen picture of the scene is no less vivid than the work of his brush. Of course such paintings as this must have been largely worked up after the occasion, from hasty sketches and from memory, notes, and imagination; but they are none the less valuable on that account. The instantaneous camera came too late for the buffalo surround. But had it come in time, it might not have caught as much of the scene as the artist's eye has caught.

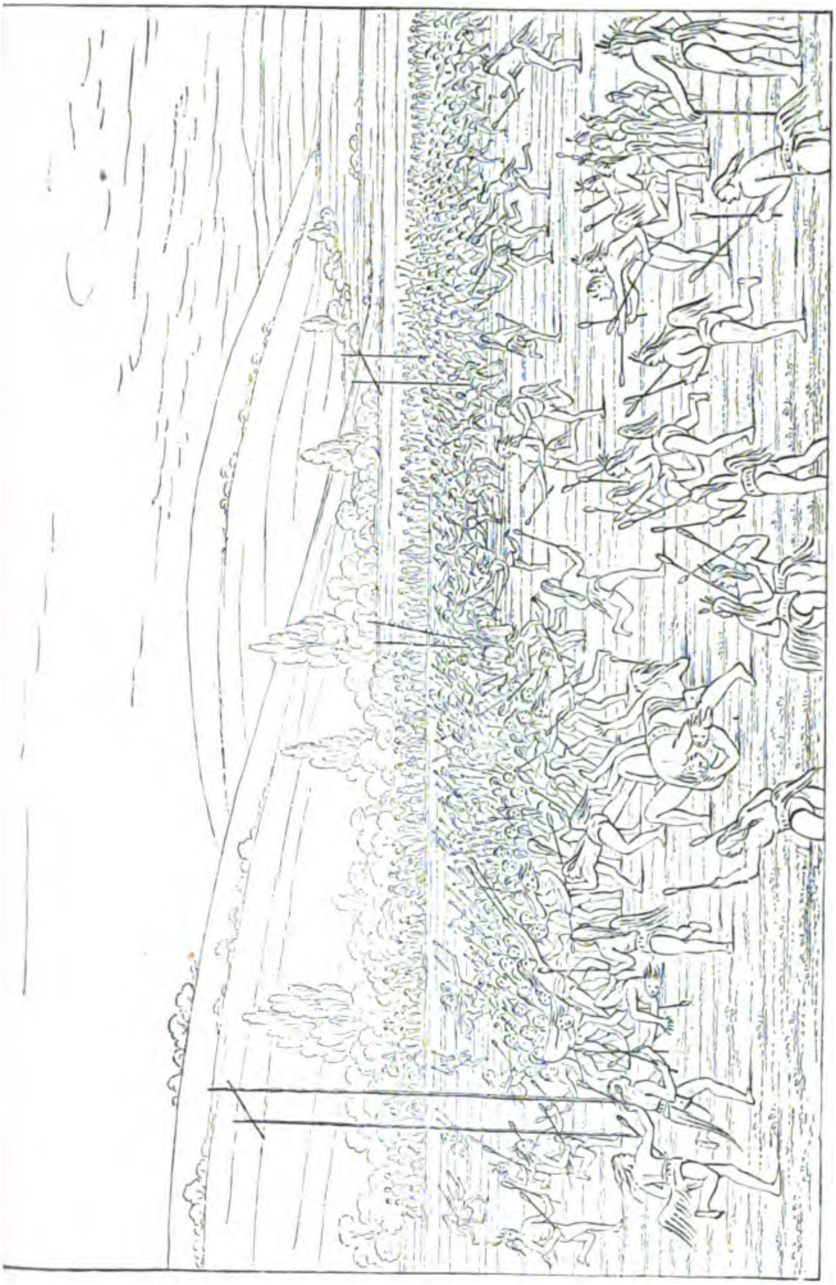
Pl. CXXXVI, Fig. 1, represents his own first chase on horseback after the buffalo at the mouth of the Yellowstone, in 1832, in company with Kenneth Mackenzie,—whose name was famous in the annals of the old trading days of the Northwest,—and a French Canadian named Chadron. As he puts himself into this picture (he is the rider in the background; it is Chadron who is climbing his charger's neck), it is reasonable to suppose that while he was riding his horse after the bison he was not also standing on the ground and making a sketch of himself. This picture is therefore a composition.

So also is the illustration presented in Pl. CXXXIX, natural and realistic as it seems. Mr. Catlin saw all the elements of this picture in different places and at different times; his artistic imagination has combined them and given us a pleasing, and for all purposes of illustration a truthful, picture. He saw walking Indians in one place, snowshoes in another, walking buffaloes in the summer in the far West, snow in some safe eastern situation in winter, and common cattle toiling through the snow from which he could imagine the pose of the bison under similar circumstances. But *this* winter hunt, or any like winter hunt, he never saw. A careful perusal of his writing will be sufficient to satisfy any one that he never visited the northern buffalo ranges in the winter, and therefore could not have witnessed such scenes. He made his itineraries in the Indian country in summer and worked up his notes and sketches in some eastern city in winter.

But the chief wealth of this gallery is in its portraits of Indians, many of whom are historic characters. He publishes many certificates of the authenticity and correctness of his portraits. To the world at large these may be of value; but, for my own part, I desire no better witnesses than the tears I have seen shed over some of them by the children and the grandchildren of the subjects.

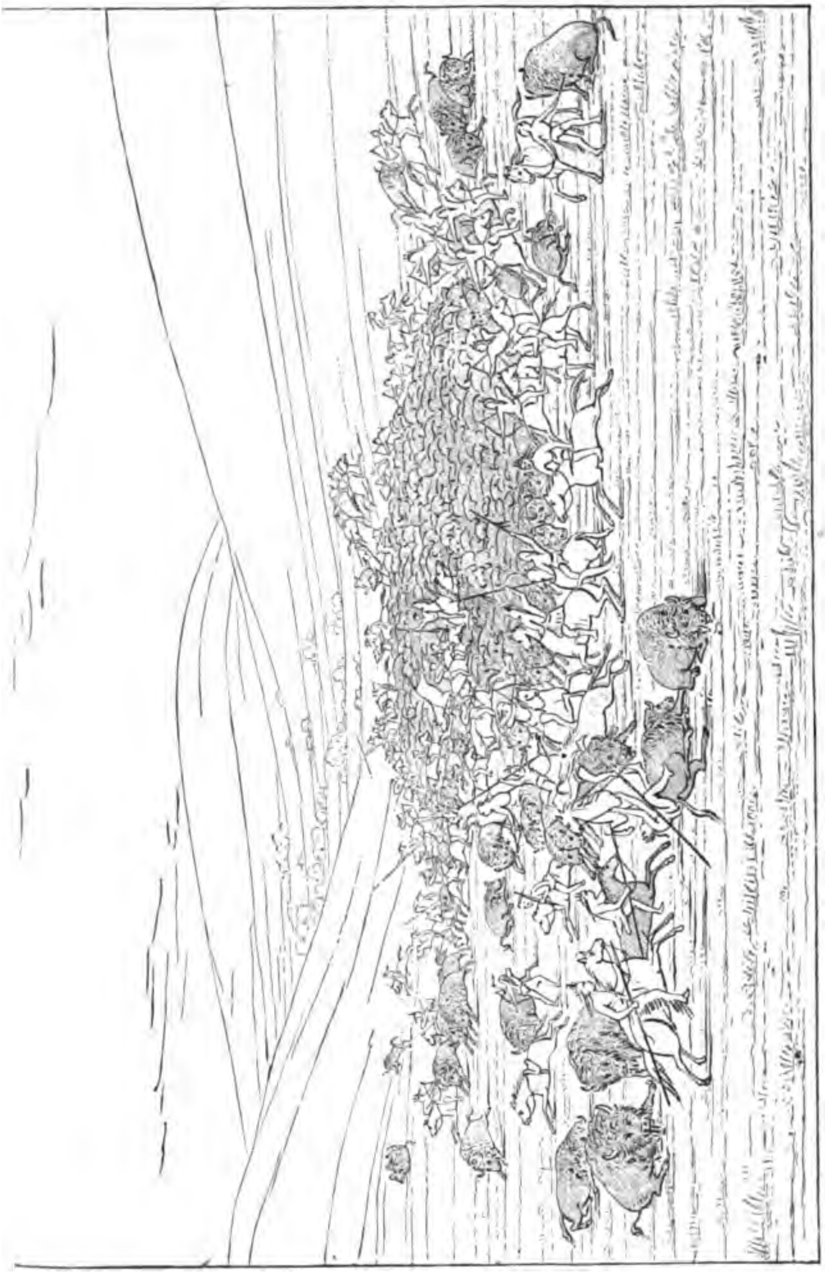
Singularly enough Catlin's works seem not to have circulated in early days in the lands in which the scenes of his labor were laid. My first acquaintance with the Mandans was made in 1865. At that time all recollection of Catlin's visit was lost, both by the Indians and the whites who lived among them. White men who had traded for years among the Indians knew nothing of him. About 4 years after my first arrival on the Upper Missouri I succeeded in getting a copy of his "Illustrations," etc., "of the North American Indians," in two volumes. This was before the days not only of railroads and express offices, but of even regular post-offices and post-roads in North Dakota, and the introduction of rare books was no easy matter. The work created the liveliest interest amongst the Indians. I lived then at Fort Stevenson (now an Indian school), some 16 miles distant from the village where the remains of the three tribes, called by Catlin the Mandans, Riccarees, and Minnetarees, were living together. The news soon spread among these Indians that I had a book containing the "faces of their fathers," and ere many days my quarters at Fort Stevenson were thronged with eager visitors. The portraits, although appearing in Catlin's plates only as light, unshaded etchings, were generally readily recognized by the children and the grandchildren of the departed heroes represented. The women rarely restrained their tears at the sight of these ancestral pictures. The men seemed to have less feeling and interest, but I soon had evidence that their indifference was affected.

Those who have read Catlin's works are aware that his most honored Indian hero was Four Bears, a chief of the Mandans, Pl. CXL. He devoted one full-page plate to Four Bears' portrait, another to his hospitality, four to his buffalo robe, an entire chapter to his personality and history, and he often refers to him elsewhere in his various works. Among those who came to see my books was a son of this Four Bears named Rushing Eagle, Pl. CXLI, or (as he was more familiarly called by the whites) Bad Gun. Rushing Eagle was the second chief of the



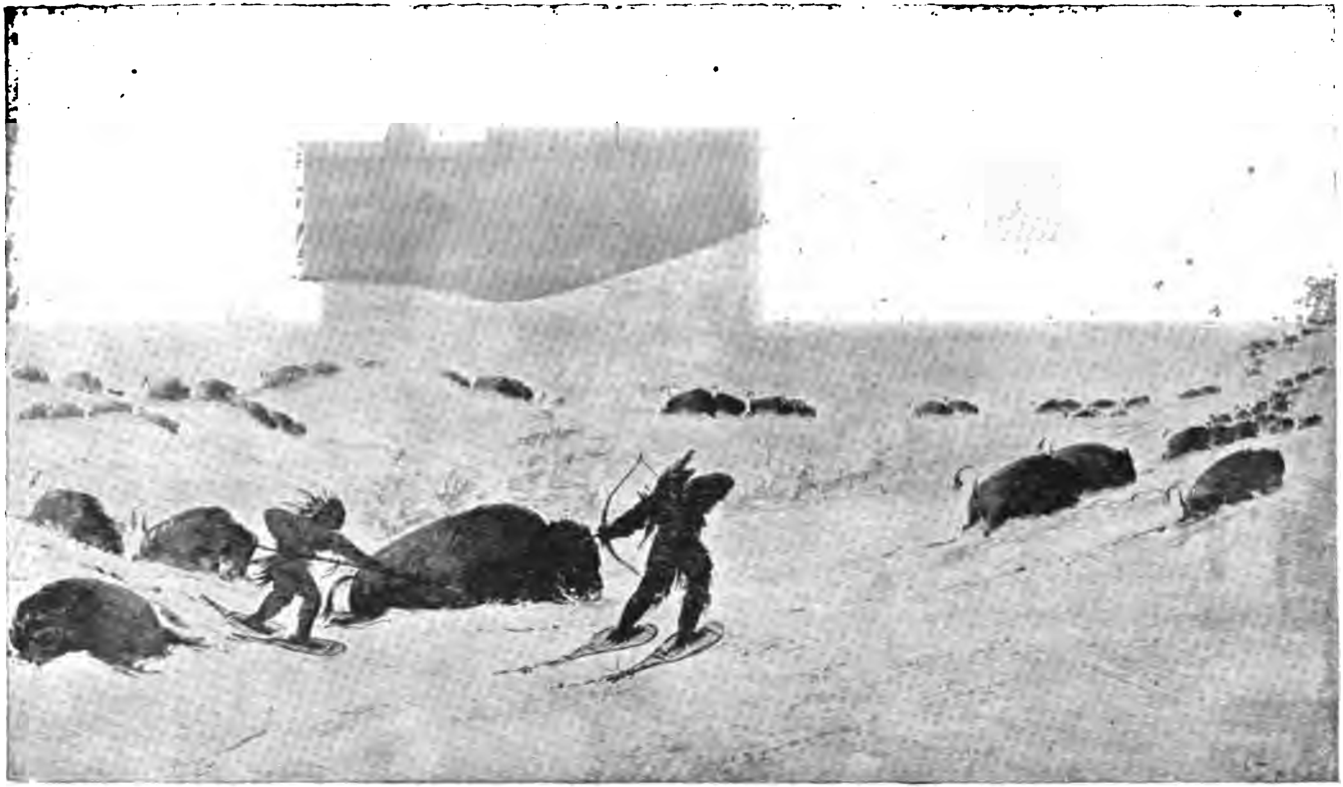
CHOCTAW BALL PLAY.

(From Donaldson's "Catlin Indian Gallery," Plate 72.)



BUFFALO SURROUND.

(From Donaldson's "Catlin Indian Gallery," Plate 69.)



HUNTING BUFFALO ON SNOW-SHOES.
(From a painting in the U. S. National Museum by George Catlin.)

Mandans. He had already earned a high reputation for himself as a warrior and counselor. He was very gentle in his manner, reticent, dignified, and disinclined to beg favors of white men. At the time of which I am speaking he was a middle-aged man. His father had been dead over thirty years, and I did not suppose that his recollection of his parent could be very vivid. At the first sight of the picture of Four Bears he showed no emotion, although he regarded it long and intently. While he was gazing at it I was called on business out of the room and I left him alone with the book, telling him, correctly, as I supposed, that I would be gone some time, and asking him not to leave until I returned; but in a few moments I was obliged to come back for something I needed. When I reëntered the apartment I found him weeping and addressing an eloquent monologue to the picture of his departed father. Of course I intruded as short a time as possible on this scene and left him long alone so that he could "have his cry out."* In 1872, when an itinerant photographer made a tour of the Upper Missouri, going as far as the mouth of the Yellowstone, I had a ferrotype of my friend Rushing Eagle made, the pose of the head approximating as closely as possible that of Catlin's picture of Four Bears. I have carried this ferrotype around with me ever since, and quite recently I have had it copied with admirable fidelity by the Moss Engraving Company, of New York ("Mosstype"). I desire here to call attention to this picture (Pl. CXLI) in connection with Catlin's portrait of the elder chief taken forty years earlier, and for this reason I introduced a copy of a portion (Pl. CXL) of Catlin's etching of Four Bears, which latter is a full-length portrait. The old men of the tribe told me that Rushing Eagle was the image of his father. Such a great resemblance does not appear in the etching; there is a general likeness, but taking feature for feature there is much dissimilarity. Remembering that Catlin's original pictures of the Indians were oil paintings, and that the etchings were but copies, I determined to examine the original which now hangs with the rest of Catlin's colection on the south wall of this hall. I have compared it with the etchng and with the picture of Rushing Eagle. It is evident that the etchng is not a careful copy of the oil painting and that the latter bears a greater resemblance to the picture of Rushing Eagle than the former. n the painting the line which marks the anterior border of the cheek omes in a straight line down to the angle of the mouth as in the face of Rushing Eagle. The etching shows a mouth of classic curves; the oil painting represents a well-formed but unconventional mouth like hat seen in the accompanying Mosstype. The jaw in the painting, like that in the Moss type, is heavier than in the etching. In both the tching and the painting the eye seems set unnaturally far back.

In comparing the etching, or even the original painting, with the portrait of Rushing Eagle, we must remember that Catlin's pictures were necessarily hasty sketches, in which he sought rather to "catch a likeness" than to copy the face with painstaking exactness, and we must also bear in mind the great difference to be observed between portrait of our own historic men painted by different artists, under different circumstances, and at different periods of life. Often in comparing such portraits we recognize in them a common subject, only by some prominent feature or by the accessories of dress.

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* This account has previously appeared in the "American Antiquarian" for Sepember, 1888.

In the picture of Rushing Eagle some expression of sadness or melancholy may be detected, which is not to be seen in the portraits of his father and, closely as this engraving copies its original, the sad expression is still more pronounced in the ferrotype. Possibly the difference results from the failure on the part of the portrait painter to transfer the mournful glance to his canvas; but if it is inherent in the living model we need not wonder. Four Bears, when Catlin knew him, was a leader of a happy, well-fed, and prosperous people, while his son, when he sat before the camera, was one of a starved and oppressed remnant, whose horoscope grew darker from day to day.

Pl. CXLII represents the face of an old chief of the Minnetarees, a neighbor and friend of Four Bears, whose hair swept the ground when his tall form stood erect. This is pronounced a wonderful likeness by all who remember the original. As his descendants were mostly females and quite numerous, the demonstrations of recognition and grief over this picture were much more notable than over that of Four Bears.

Pl. CXLIII is a reproduction of his much-copied portrait of the famous Iroquois chief whose name is thus mentioned by Fitz Greene Halleck:

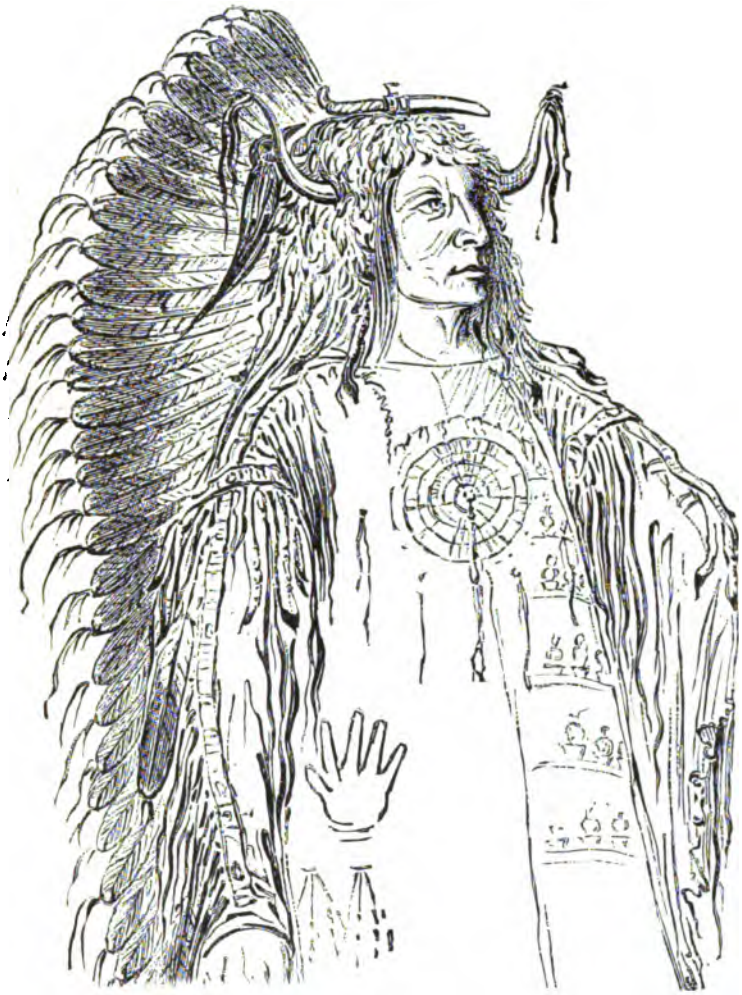
> Thy name is princely, though no poet's magic,
> Could make *Red Jacket* grace an English rhyme,
> Unless he had a genius for the tragic,
> And introduced it into pantomime.

The artist indulged him in the wish he expressed, "that he might be seen standing on the table rock at the falls of Niagara, about which place he thought his spirit would linger after he was dead."

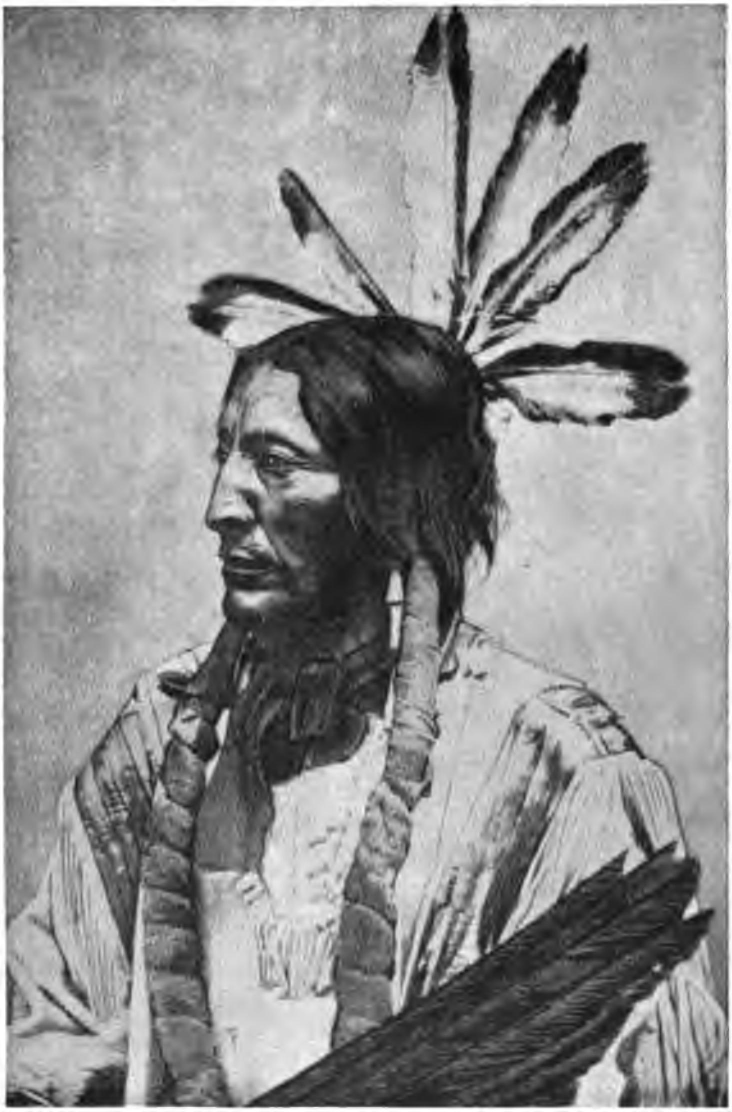
Perhaps it was this portrait that Halleck, in the poem already quoted, referred to when he exclaimed:

> If he were with me, King of Tuscarora,
> Gazing as I, upon thy portrait now,
> In all its medaled, fringed, and beaded glory,
> Its eyes' dark beauty and its thoughtful brow—
>
> Its brow half martial and half diplomatic,
> Its eye upsoaring, like an eagle's wings;
> Well might he boast that we, the democratic,
> Outrival Europe—even in our kings.

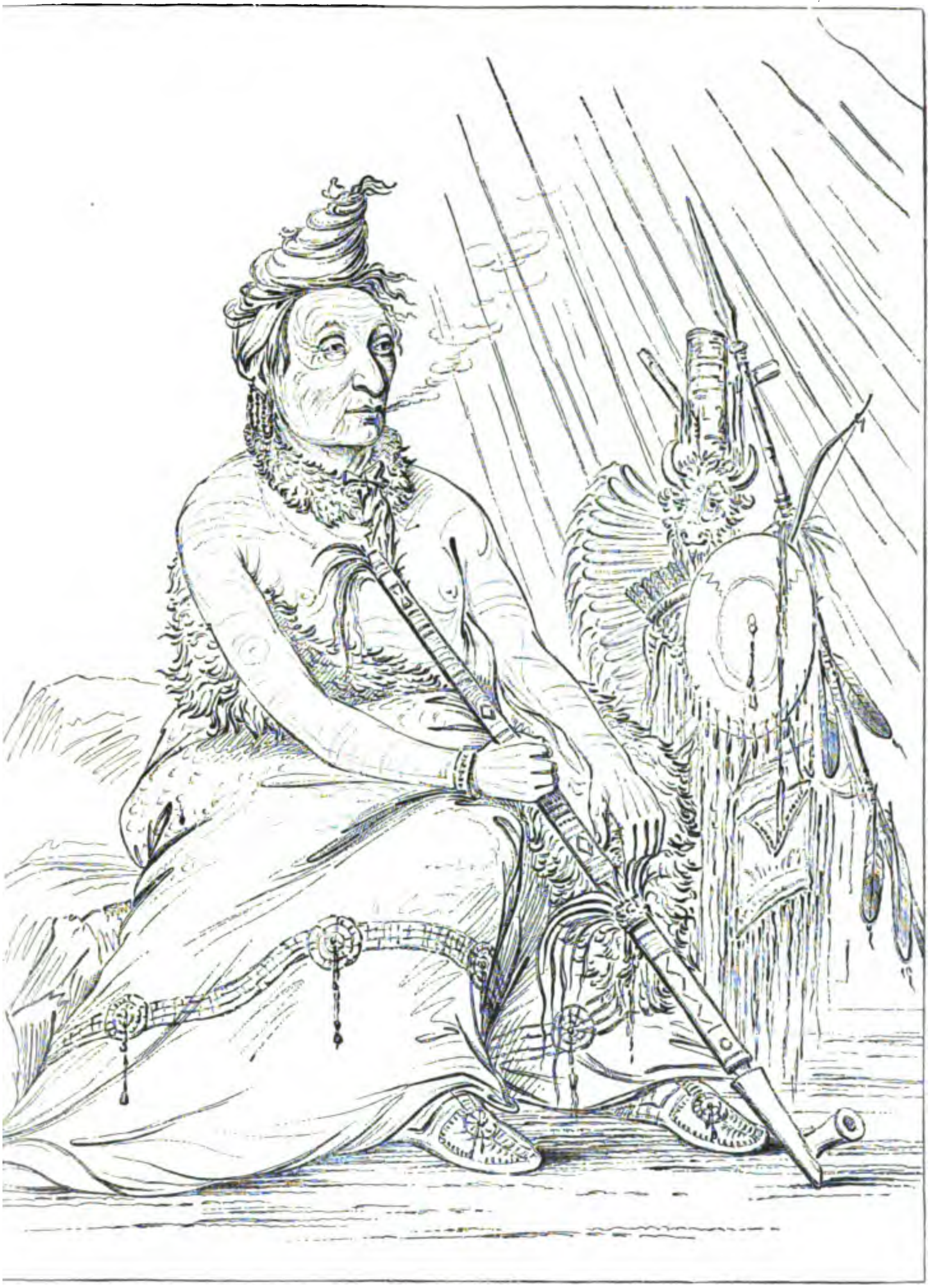
"Red Jacket" was, however, but a white man's nickname. Had the poet bethought him of the true Indian name he might have found better suited to his verse. This name was Sagoyeqwatha, or Keep



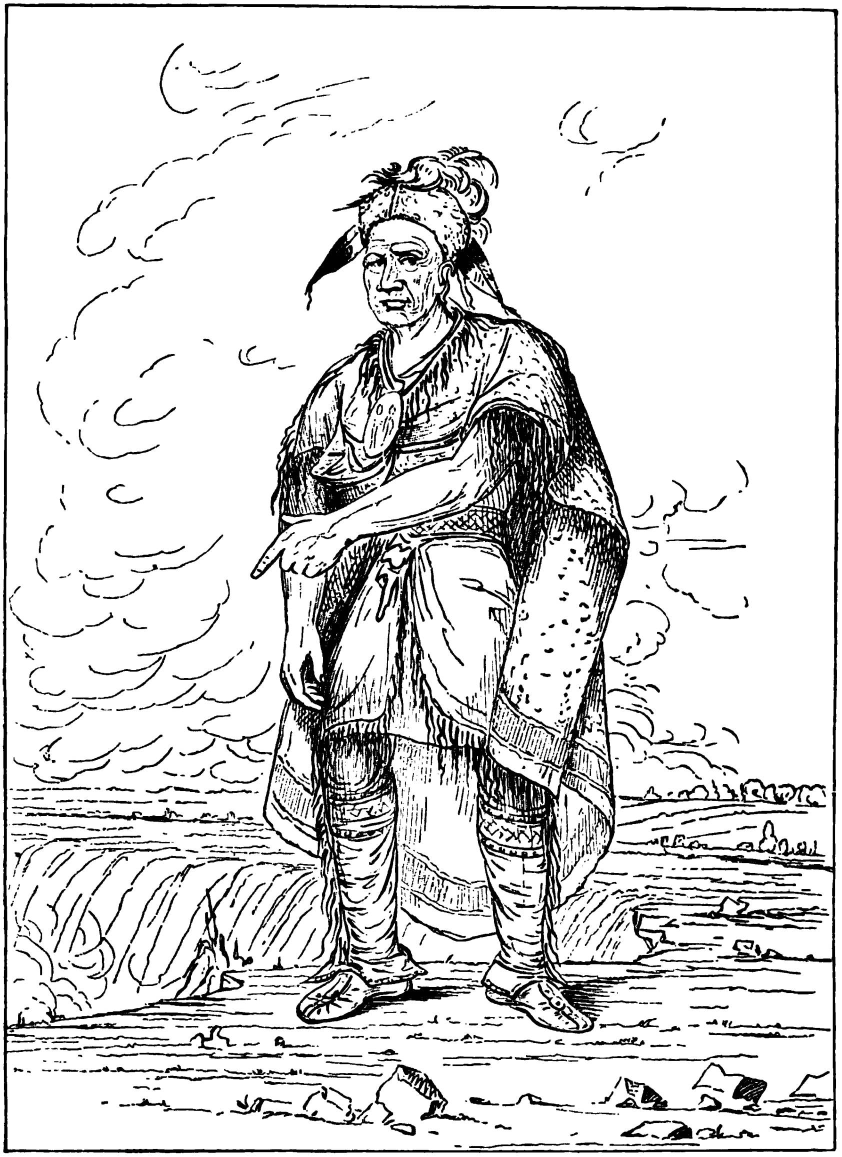
FOUR BEARS, 1832.



RUSHING EAGLE, 1872.



BLACK MOCCASIN, CHIEF OF THE MINNETAREES.
(From Donaldson's "Catlin Indian Gallery," Plate 46.)



RED JACKET.

(From Donaldson's "Catlin Indian Gallery," Plate 55.)

Awake. He was so called because within the sounds of his eloquent voice sleep was impossible.

In Pl. CXLIV is seen the sad face of the young Seminole fighter, Osceola, who made himself notorious in the third decade of this century, and ended his sanguinary career a prisoner at Fort Moultrie, when but little over thirty years of age.

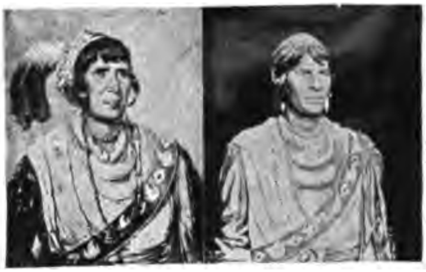
The picture to the left is from Catlin's canvas, painted while the subject was a prisoner. The picture on the right is from a bust in the National Museum which has for its basis Osceola's death-mask. An interesting difference is to be observed between these two pictures. Osceola, on his father's side, was the grandson of a Welshman, and as such inherited the name of Powell. In Catlin's portrait the European element in the features is more pronounced. In the bust from the death-mask it is the Indian element which is the more prominent. This is largely due no doubt to the shrinkage of the tissues of the face during the fatal illness, which caused the eyes to sink and the bony frame of the physiognomy to become more marked.

Among the portraits are two of Keokuk (one on foot, as shown in Pl. CXLV and one on horseback), a celebrated Sauk chief, from whom the present city of Keokuk, in Iowa, is named, and whose bust now occupies a place in the Capitol; one of Black Hawk (Pl. CXLVI), whose name is given to one of the severest wars our pioneers ever experienced, against whose forces Abraham Lincoln served in his youth as a volunteer private; and many others of great historic value.

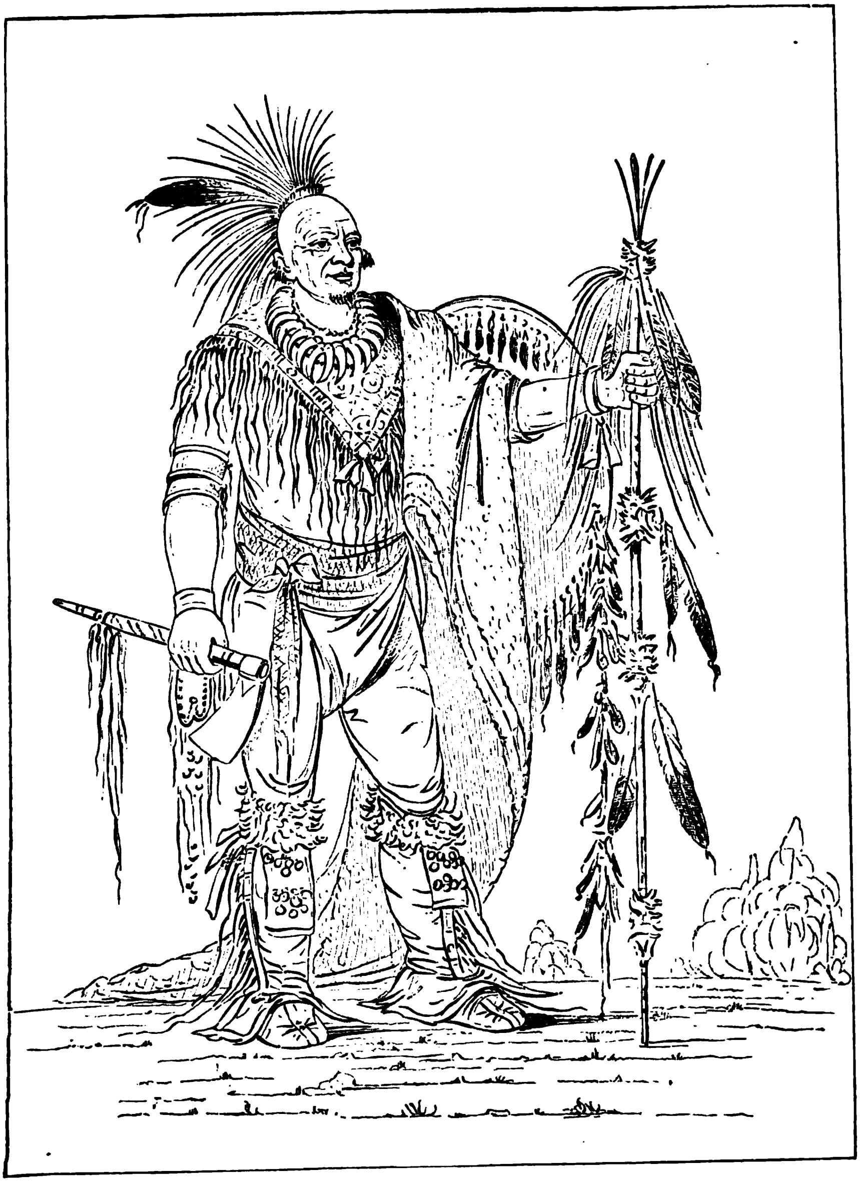
I now come to consider four pictures in the gallery which have given rise to more controversy and comment than all the rest of the work combined, and which were at once his glory and his misfortune. These are his pictures of a certain religious ceremony of the Mandans called Okeepa. They were his glory because in them he depicts one of the most extraordinary rites that the eye of civilized man has ever witnessed, and because they were the first pictorial representations ever made of the esoteric work of an Indian medicine lodge. His description of these rites is no less wonderful and faithful than his pictures. They were his misfortune because the scenes he described and painted were so unusual that they were discredited by his jealous scientific contemporaries, and such doubts were cast upon his work as to interfere with the sale of his gallery in France, and later in the United States. Mr. Schoolcraft was the official ethnographer in those days, and his dictum seemed to settle all questions. In his immense six-volumed compilation entitled "Information respecting the History, Condition, and Prospects of the Indian Tribes of the United States," he generally ignores the great work of Catlin, but he publishes a letter dated June 28, 1852, by a "colonel" who was superintendent of Indian affairs in those days. The letter of this "colonel" indicates throughout a most superficial second-hand knowledge of the subject of which he treats, and the only reference he makes to Catlin's labors is in the closing sentence, which reads as follows: "The scenes described by Mr. Catlin existed almost entirely in the fertile imagination of that gentleman." Thus by a pebble from the sling of a pigmy was our giant of ethnography felled. And doubts are still cast on this work, although witnesses abound who testify to its verity. Catlin took pains to secure the certificates of Mr. Kipp and his assistants, and he published these certificates. The year following Catlin's visit, the Prince of Wied sojourned a whole winter among the Mandans, and, through interpreters, obtained accounts of the ceremonies, corroborating those of Catlin. All this was on record before Schoolcraft's day, but was not sufficient to stay the publication of the quoted calumny. Since then (in 1860, twenty-eight years after Catlin wrote, and twenty-two years after the Mandans were supposed by Catlin to have been exterminated, Lieut. H. E. Maynadier, of our Army, witnessed a part of the Okeepa and describes it much as Catlin did. But there is still another and a later witness and this witness has the honor of addressing you this evening. The portion of the ceremony which I saw and am prepared to testify to will presently be illustrated.

The picture which is now before us (Pl. CXLVII) shows the inside of the medicine lodge as it appeared during the first three days and part of the fourth day of the ceremony. The young candidates for warriorhood are seen reclining around the edge of the apartment. Above each man's head are his shield and weapons and the walls are decorated with fascicles of green willows. On a light frame, toward the back of the lodge, is seen a sacred object, the holy of holies of this lodge, whose appearance and nature Catlin was unable to discover. Under the frame are the knife and skewers to be used in the cruel manner described later. In the center of the foreground is the circular fireplace; on either side of the latter are the ancient turtle-shaped drums filled with water, so say the shamans, from the four quarters of the world. Behind the fireplace, the master of the lodge with upraised hand invokes the mysterious powers. These young candidates are preparing themselves by fasting and praying for the appalling tortures they are about to undergo. For four days and three nights they neither eat nor drink. There are a goodly number of these candidates, the annual crop of young men in those, the halcyon days of the tribe.

In this picture (Pl. CXLVIII) we see the plaza or central assembly place of the old Mandan village of Metutahankush as it appeared in [illegible] This village stood near the site of the present town of Mandan, North Dakota. To the left we see the medicine lodge, with four [illegible] in front surrounded by sacred effigies and, in the center of the square, a cylindrical wooden structure, resembling a hogshead, which was emblematic of the ark in which the Mandan counterpart of Noah was saved from the flood. Forty years after Catlin's time, when the remnant of the Mandans had established themselves in a new village [illegible] miles from the old one and resumed their tribal ceremonies, they [illegible]

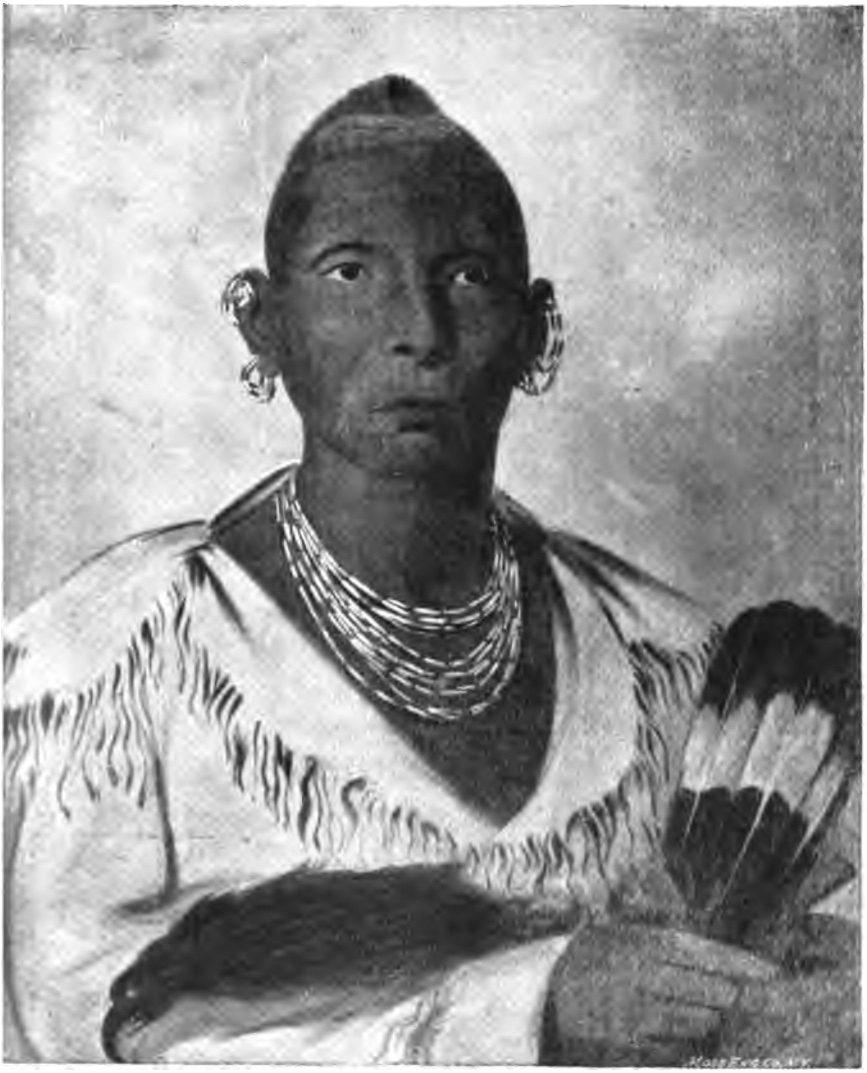


PORTRAITS OF OSCEOLA.



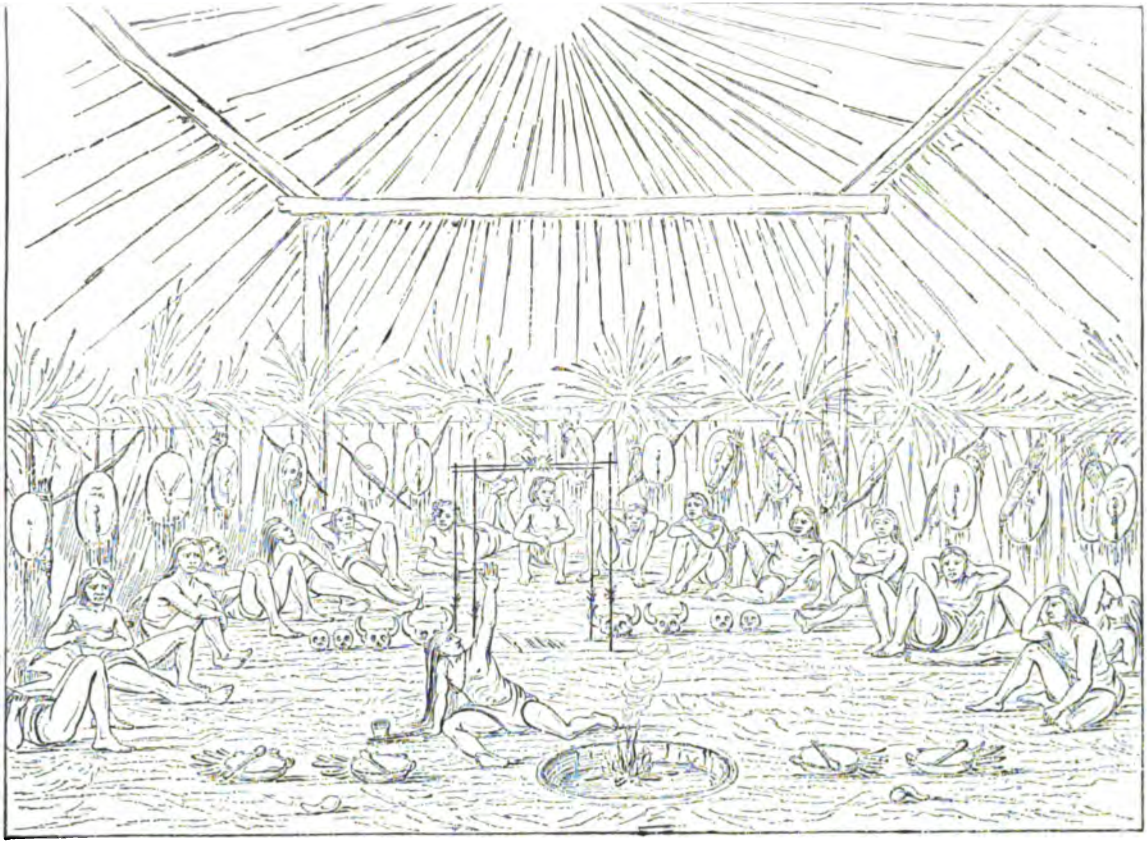
KEOKUK.

(From Donaldson's " Catlin Indian Gallery," Plate 10.)



BLACK HAWK.

(From painting in the U. S. National Museum by George Catlin.)



INTERIOR OF MANDAN MEDICINE LODGE DURING FIRST THREE DAYS OF THE OKEEPA.

(From Donaldson's "Catlin Indian Gallery," Plate 92.)

just such another ark and erected similar poles and effigies. The picture of the old village plaza would have done without alteration for that of the new.

While the youths are starving within, their kindred outside are not idle. They are performing the buffalo dance, a rite rich in Indian symbolism, to insure the increase and preservation of the bison. A most successful dance it was, too, in attaining its object before the introduction of powder and ball. This picture represents the dance at the moment of the advent of the evil one, who, painted in black, is seen entering the arena on the left.

Knowing from observation that in the waxworks the chamber of horrors is the most crowded part of the establishment, and that a fair proportion of the crowd are ladies and children, I have little hesitancy in exhibiting the next picture. What has gone before is but child's play; now we come to the earnest work of the ceremony.

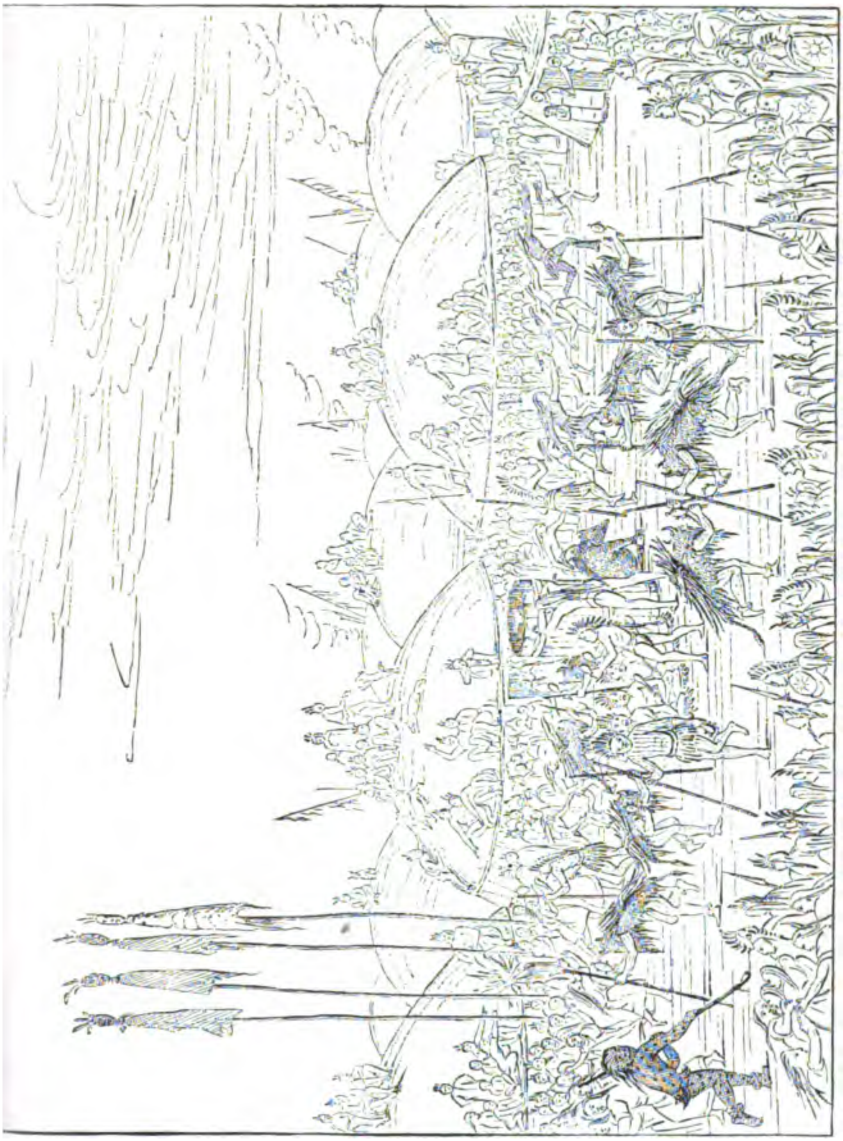
With this preparation, I now place before you the scene in the medicine lodge on the fourth day (Pl. CXLIX). Around the wall in this picture are seen some of the fasting candidates who are waiting for their dread turn to come. Other young men who have passed the ordeal have gone outside to participate in the last dance, which will next be exhibited (Pl. CL). To the right is seen a youth on whom the torturers have just commenced operations. The following is Catlin's description, somewhat condensed, of this portion of the rites.

> An inch or more of the flesh on each shoulder or each breast was taken up between the thumb and finger, and the knife which had been ground sharp on both edges and then hacked to make it produce as much pain as possible, was forced through the flesh below the fingers, and being withdrawn, was followed with a skewer from the man who held a bunch of such in his left hand and was ready to force them through the wound. There were then two cords lowered from the top of the lodge (by men stationed outside) which were fastened to these splints or skewers, and they instantly began to haul the victim up. He was thus raised until he was suspended from the ground, where he rested until a knife and a skewer were passed through the flesh or integuments in a similar manner on each side below the shoulder, below the elbow, on the thigh, and below the knees.
>
> He was then instantly raised with the cords until the weight of his body was suspended by them, and then while the blood was streaming down his limbs the bystanders hung upon the splints his shield, bow, quiver, etc., and (in many instances) the skull of a buffalo. When these things were all adjusted he was raised higher by the cords until those weights all swung clear from the ground. In this plight he at once became appalling and frightful to look at. The flesh, to support the weight, was raised six or eight inches by the skewers, and the head sunk forward on the breast or thrown backward in a much more frightful condition.
>
> The unflinching fortitude with which every one of them bore this part of the torture surpassed credulity; each one as the knife passed through the flesh sustained an unchangeable countenance, and several of them, seeing me making sketches, beckoned me to look at their faces, which I watched all through this horrid operation without being able to detect anything but the pleasantest smiles as they looked me in the eye, while I could hear the knife rip through the flesh and feel enough of it myself to start involuntary and uncontrollable tears over my cheeks.

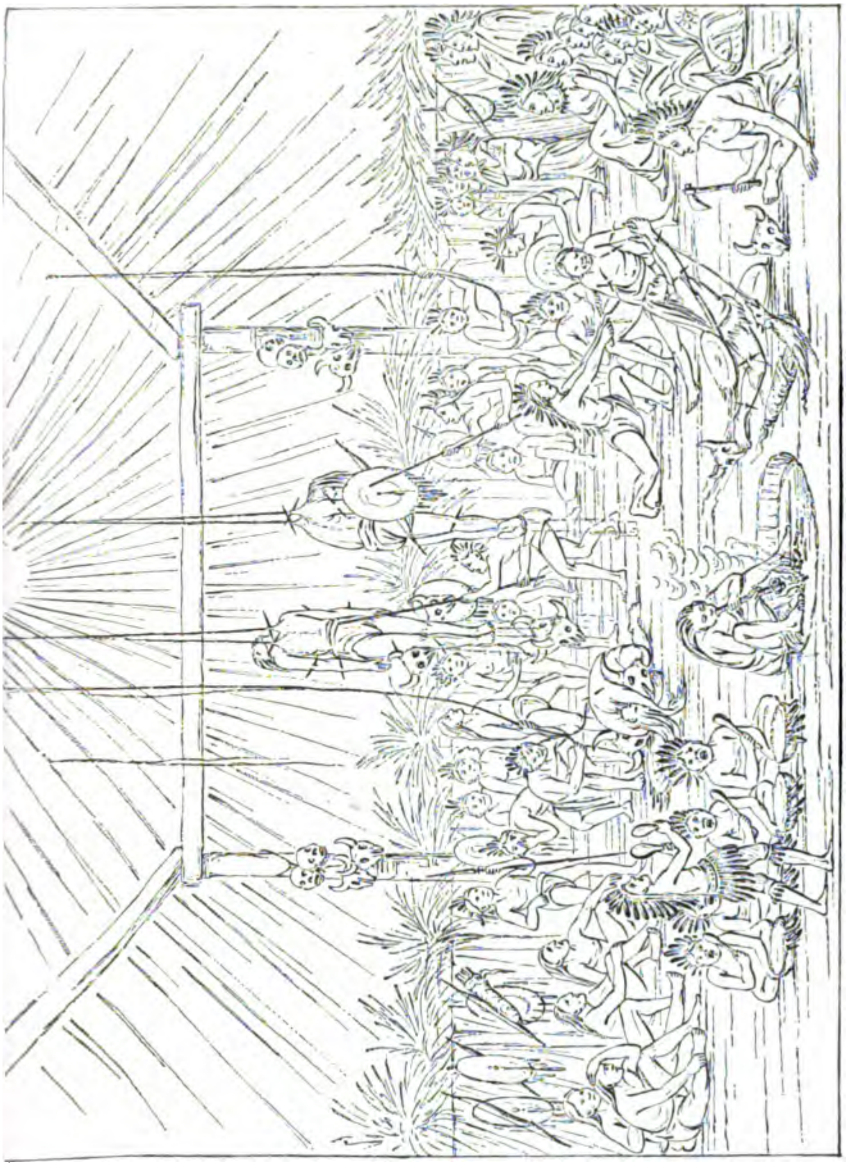
The next operation on each suspended candidate is thus described:

> Surrounded by imps and demons as they appear, a dozen or more, who seem devising means for his exquisite agony, gather around him when one of the number advances toward him in a sneering manner and commences turning him round with a pole. This done gently at first is gradually increased, when the brave fellow whose proud spirit can control its agony no longer, bursts out in the most lamentable and heart rending cries that the human voice is capable of producing, crying forth a prayer to the Great Spirit to support and protect him in this great trial. In this condition he is turned faster and faster until, by fainting, his voice falters and he hangs apparently a lifeless corpse. When brought to this alarming and frightful condition, when his tongue is distended from his mouth, and his medicine bag, which he has affectionately and superstitiously clung to with his left hand, has dropped to the ground, the signal is given to the men on top of the lodge, when they carefully lower him to the ground.
>
> In this helpless condition he lies like a loathsome corpse to look at. One of the bystanders advances and pulls out the pins from the breasts or shoulders, thereby disengaging him from the cords by which he has been hung up, but leaving all the others with their weights hanging to his flesh.
>
> In this condition he lies for six or eight minutes, until he gets strength to rise, for no one is allowed to assist him.
>
> As soon as he is able to drag his body around the lodge he crawls, with the weights still hanging to his body, to where an Indian, hatchet in hand, sits behind a dried buffalo skull, and here, in the most earnest and humble manner, by holding up the little finger of the left hand to the Great Spirit, he expresses to him in a brief speech his willingness to sacrifice it; then he lays it on the buffalo skull, and the other chops it off near the hand with a blow of the hatchet.
>
> Sometimes more than one finger is sacrificed, and no treatment of the wound is permitted.

As I have intimated before, I have witnessed something of these ceremonies. I had been some years on the upper Missouri before I became aware of the existence of such rites, and my first knowledge of them was secured through the perusal of Catlin's works. When I read of them I asked some white men who had lived many years in the country and in the same village with the Mandans, but they declared they knew nothing of them, and they even doubted the trustworthiness of the pictures. Had I been one of the doubting know-alls, how easily could I have cast another stone at the prostrate Catlin. Such is the value of negative evidence. But in time I found some old Mandans to consult. These put their astonished hands over their open mouths and groaned in wonder when they beheld the etchings. I was promised a vision of the ceremonies on the following summer if I were still in the country. Some time next year, the summer of 1869, I was duly notified that the ceremonies had begun, but no one could have told in advance when they were to begin, for none knew but the medicine men, and they were not supposed to know when *Numak-machani*, the Mandan Adam, would visit the village and open the rites. I lived then some sixty miles from the Mandan village, and was so hampered with my duties when the news arrived that I was unable to set out until after midnight on the third night of the ceremonies, and I was able to witness only part of the fourth day's performance. Among other things, I saw the



BULL DANCE. MANDAN CEREMONY OF THE OKEEPA.
(From Donaldson's "Catlin Indian Gallery," Plate 98.)



CUTTING SCENE. MANDAN CEREMONY OF THE OKEEPA.

(From Donaldson's "Catlin Indian Gallery," Plate 94.)

dance called the last dance (Pl. CL), and to the accuracy of Catlin's description and delineation of this I am prepared to testify.

After the youths have been tortured in the lodge, as described, they are led out of it with the weights, buffalo skulls, etc., hanging to their flesh. Around the big canoe (*i. e.*, the wooden cylinder) is formed a circle of young men, who hold wreaths of willow boughs between them, and run around with all possible violence, yelling as loud as they can.

The young fellows who have been tortured are then led forward and each one has assigned to him two athletic, fresh young men (their bodies singularly painted), who step up to him, one on each side, take him by a leathern strap tied around the wrist, and run around outside the other circle with all possible speed, forcing him forward until he faints. Then they continue to drag him, with his face in the dirt, until the weights are all disengaged by tearing the flesh out. The skewers are never withdrawn lengthwise. They then drop him and fly through the crowd away upon the prairie, as if they were guilty of some enormous crime and were fleeing from summary vengeance. The victim lies to all appearance a corpse, unaided, until his strength returns, and he walks home to his lodge, where he is at last kindly cared for and fed, and his sufferings are at an end.

There are many more extraordinary occurrences in the ceremonies, for which I must refer the curious to Catlin's works.[*] He tells us that when he saw the rites some forty-five or fifty youths submitted themselves to the torture. When I beheld them there were but four candidates, and two of these were members of other tribes who, for some reason, had chosen to go through the Mandan initiation. Such was the change wrought in less than four decades.

Mr. Catlin's artistic labors did not end with the formation of this gallery. After it had passed from his hands he again set out on his journeys and traveled extensively in North and South America, making sketches as he went. The materials collected in these later wanderings are, I understand, in the hands of his heirs. I trust the time may soon come when they will be added to the more famous collection which we now possess.

The history of this collection is as romantic and eventful as that of its author, and the preservation of the collection to the present day seems little less than providential.

The sketches, taken in desolate and hostile lands, were borne on horseback over dim trails, or in frail canoes and bull-boats along the currents of treacherous streams, before they reached places of comparative safety in the white settlements.

When, in 1837, after eight years of travel and labor, the collection was nearly completed, it began its tour of the civilized world, only to encounter dangers more imminent than those which threatened it in the wilderness.

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[*] "Illustrations of the Manners, Customs, and Condition of the North American Indians." 10th edition, London, 1866, vol. 1, p. 155 *et seq.* Okeepa, a Religious Ceremony and other Customs of the Mandans. Philadelphia, 1867; and other works of Catlin.

In the years 1837-'39 it made the tour of the then principal cities of the Union. The present is not its first appearance in the nation capital. It knew Washington in the days of its dingy youth, long er it gave promise of becoming the most beautiful capital in the world.

When in 1839 the collection made its first voyage across the Atlant it encountered a storm which was weathered with difficulty. Durin the twelve succeeding years it was exhibited in London and many o the smaller cities of the British Isles, in France, and in Belgium.

In France it so pleased the king, Louis Philippe, who had travele as a fugitive in America in earlier days and seen much of the Indian that he gave it a place in the palace of the Louvre, and began to consider the propriety of purchasing it. Here it might be supposed it ha at last reached an asylum, but, as subsequent events showed, it nev was in greater danger than when established in these princely qu ters. Soon afterwards the revolution of 1848 broke out; the citiz king, assuming the modest name of Mr. Smith, fled to England, an Catlin was only too glad to rescue his collection and follow his ro patron across the channel.

Landed in England, perils of another kind awaited it. Mr. Catl speculated unwisely and the collection was seized for debt in 1852.

Rescued from the hands of the creditors by a generous citizen Philadelphia, who happened to be in England at the time, Mr. Jos Harrison, it again crossed the ocean to what we might call its nat land; here it lay for years in different lofts and storehouses in Philadphia. While in this ignoble seclusion it twice ran the risk of destrution by fire and was, with difficulty, saved. Some of the canvas s shows the defacing marks of smoke and flame and of the waters us to extinguish the fires.

For more than a quarter of a century it thus lay hidden until, in th year 1879, it was presented to the nation by Mrs. Harrison and broug for the second and, let us hope, the last time to the city of Washin

Mr. Thomas Donaldson, through whose instrumentality largely t collection was secured for the people, tells us, "Mr. Catlin first offe his gallery to the Smithsonian Institution in 1846; thirty-five ye afterwards it found a permanent lodgment in the same institution af vicissitudes and misfortunes hardly equaled."[*]

And here it rests at last, in an isolated fireproof building, in a c which has no mob element to threaten, in the possession of a sover people whose property can not be seized for debt, as nearly safe fr danger as anything human can well be. Let us hope that it will b remain to instruct and entertain the multitudes who will in future v this hall, and to record a stage of human development and an era the history of our land which have passed totally and forever.

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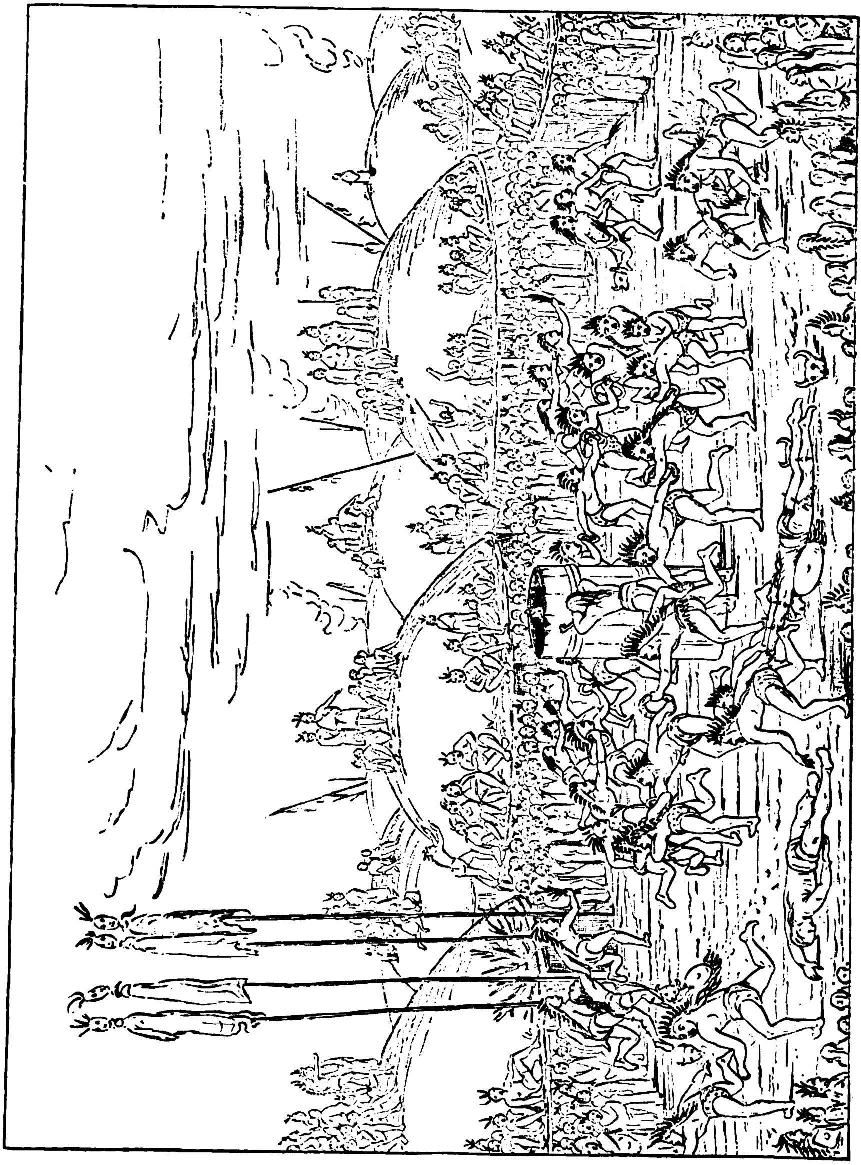
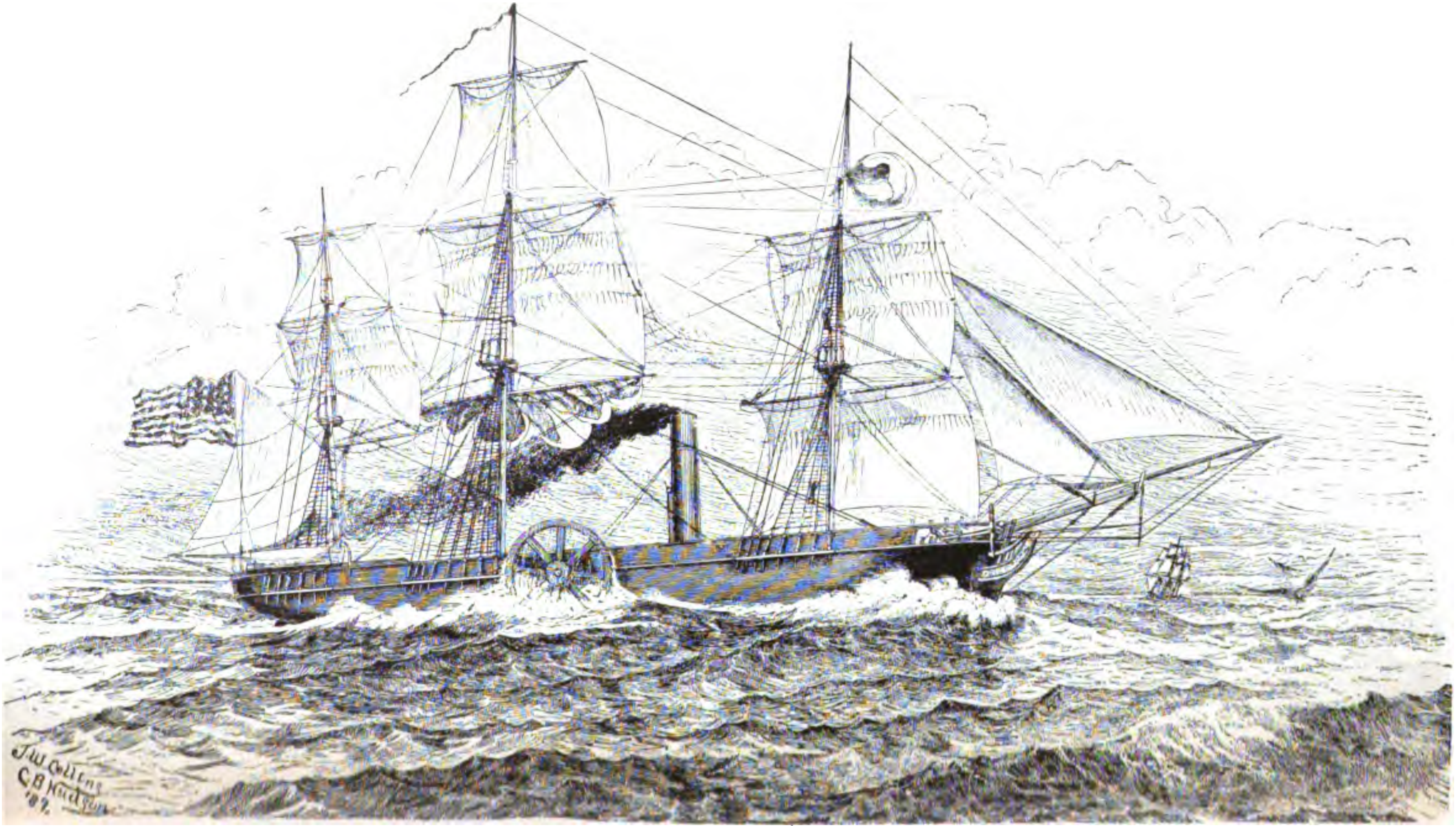
[*] *Op. cit.*, p. 6.



THE LAST DANCE. MANDAN CEREMONY OF THE OKEEPA.

(From Donaldson's "Catlin Indian Gallery," Plate 95.)



THE STEAMSHIP SAVANNAH.

[illegible]

# THE LOG OF THE SAVANNAH.

By J. Elfreth Watkins,
*Curator of the Section of Transportation and Engineering, U. S. National Museum.*

The first voyages of a steamship across the Atlantic were made in 1819, by the *Savannah*, an American vessel carrying the American flag and manned by an American crew.

It seems eminently proper to preserve an authentic record of the events connected therewith in our national archives, particularly since the original log-book of these voyages is in the collection of the U. S. National Museum.

So far as is known, no reliable drawings of the *Savannah* are in existence. A lithograph, faulty in many of the details of hull, sails, and rigging, has been the basis of all previous illustrations of this historic vessel.

In view of this fact a corrected drawing (Plate CLI) based upon early descriptions of the vessel, together with such details of construction as are extant, has been made by Mr. C. B. Hudson, under the supervision of Capt. J. W. Collins, of the U. S. Commission of Fish and Fisheries, and Curator of the Section of Naval Architecture in the National Museum, whose familiarity with the history of naval architecture and the construction of sailing vessels, contemporary with the *Savannah*, has enabled him to correct many errors and supply the deficiencies in the original lithograph.

The following notes, explanatory of certain technicalities in the drawing, have been furnished by Captain Collins:

> The history of the *Savannah* shows that she was designed, originally, for a sailing ship; that her construction was already well advanced when it was determined to make a steamship of her, and that she was rigged as a sailing vessel, steam apparently being considered chiefly auxiliary, to be used principally in calms or with light or head winds. The contemporaneous lithograph and all other illustrations of this famous vessel represent her as a full-rigged ship, with, however, no sails loftier than topgallant sails; with her mainmast and foremast more widely separated than on ships designed for sail alone, and having a round stern.
>
> The sailing ships of that period were usually rigged very loftily, commonly carrying royals, while the almost universal type of stern was square. Nevertheless, it is reasonable to suppose that those having charge of the rig and equipment of the

*Savannah* may have felt that lofty light sails, which could be used only in moderate winds, would not be necessary on a ship having steam as an auxiliary motive power, and that her stern was round is by no means impossible. Therefore, not having any authority for changing these details, they have been represented as in the original lithograph; the relative positions of the masts, smokestack, and wheels are also retained.

In all details of hull and rig, with the exception of those mentioned, the effort has been to produce a ship of the period when the *Savannah* was built, and special attention has been given to the details of sails and rigging, points in which all illustrations of this ship, previously extant, were markedly erroneous and unsatisfactory.

The ship is represented close hauled on the starboard tack, in a fresh breeze, with her paddle-wheels in motion. She is rising on the slope of an Atlantic swell, leaning well over to the breeze, while the yeastly wave curling away from her bow, and sweeping in foam along her sides, indicates that she is moving at a good speed. The fore-topgallant sail has just been clewed up and two seamen are seen climbing the rigging to furl the canvas, while in the distance another ship is in sight, running before the wind with square yards.

It is to be regretted that no drawings or detailed description of the engines, machinery, or wheels are to be found.

In collecting the data[*] for this report I have been greatly aided by Mrs. Delia Rogers Seely, wife of Col. F. A. Seely, examiner in the U. S. Patent Office, who is a grand-daughter of Capt. Moses Rogers, the commander of the *Savannah*.

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[*] For this compilation, in addition to a number of clippings from newspapers of the day, which had been carefully preserved in the last pages of the log book by the descendants of Captain Rogers, the following authorities have been consulted:

Chronological History of the Origin and Development of Steam Navigation. George Henry Preble, U. S. Navy, Philadelphia, Hamersley & Co. 1883.

A History of Naval Architecture. John Finchman, London. Whittaker & Co. 1851.

The Mechanic's Magazine to 1853.

London Athæneum.

A Description and Draft of a new Invented Machine for Carrying Vessels or Ships out of or into any Harbor, Port, or River, against Wind and Tide, or in a Calm, etc. By Jonathan Hulls, London, printed for the author, 1737. (Reprint by Spon, 1873.)

A short Treatise on the Application of Steam whereby is clearly shown from Actual Experiments that Steam may be Applied to Propel Boats or Vessels. By James Rumsey, of Berkley County, Virginia. Philadelphia. Joseph James, 1788.

The Original Steamboat Supported, or a Reply to James Rumsey's Pamphlet, showing the true Priority of John Fitch and the false datings of James Rumsey. Philadelphia. Zachariah Poulson, jr. 1788.

The Log Book of the *Savannah*. H. Carrington Bolton. Harper's Magazine, February, 1877.

Early Atlantic Steam Navigation and the Cruise of the *Savannah*. Eustace B. Rogers, U. S. Navy, Ballou's Magazine, February, 1883.

Ocean Steamers, by Thomas Dykes, Fornightly Review, May, 1886.

The Development of the Steamship, Commander F. E. Chadwick, U. S. Navy. Scribner's Magazine, May, 1887.

Early Clyde Built Steamers. Paper by W. J. Millar, C. E., Transactions of Institution of Engineers and Ship Builders in Scotland. 1880.

The History of Paddle Wheel Steam Navigation, Henry Sandham. Proceedings Institution Mechanical Engineers, March, 1885.

### PROJECTS AND EXPERIMENTS.

To navigate the ocean by a vessel propelled by steam was the dream of many inventors years before a successful steamboat had been put in service.* Although Papin's and Savery's experiments, in the seventeenth century, had been devoted to perfecting stationary engines for raising water from the mines, in addition to the proposal of the former "to apply this power to draw water or ore from mines, and to discharge iron bullets to a great distance," he also states that the power can be used † "to propel ships against the wind" by an arrangement of paddle-wheels, which he describes. It does not appear, however, that he ever attempted to construct even an experimental steamboat. Nor does it appear that Savery, who constructed several pumping engines, made a commercial success of any of them. Although he in 1696 obtained a patent "for rowing ships with greater ease and expedition than had hitherto been done by any other," and in 1698 stated that he still "believed steam might be made useful to ships," his ideas took no tangible form.

John Barrow, under-secretary of the English admiralty, in his autobiography states: "There can be no doubt that Jonathan Hulls (1737) was the real inventor of the steamboat." Hulls, in a pamphlet published in 737, gives detailed drawings and a full description of the manner of applying the power of steam to drive a stern-wheel towboat, with wheels similar in design to those on the boats now in use on the Ohio River. This was the first practical proposition in the history of steam navigation, and so thoroughly did Hulls understand the subject, that the mechanic of to-day could build the steam machinery for a boat upon his plans that would go against the stream on most American rivers. He proposed to use the type of engine which Newcomen, profiting by the experiments of Papin and Savery, had greatly improved. Although Hulls' plans were so ably drawn, it does not appear that he constructed a boat. It was not until after Watt (who began to improve the steam-engine where Newcomen left off), a half century later, met with success in perfecting the stationary engine—a success which demonstrated that he was the most prolific inventor of the age—

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* Opinions eighteen years before and sixteen years after the first transatlantic voyage of the steamship *Savannah :*

"This, sir, whether I bring it to perfection or not, will be the mode of crossing the Atlantic in time, for packets and armed vessels." (Extract from letter written in 1791, by John Fitch to David Rittenhouse, the Philadelphia astronomer, in which he solicited a loan to complete the steamboat, with which he had been experimenting in the Delaware River.)

"As to the project, which is announced in the newspapers, of making a voyage direct from New York to Liverpool (by steamship), it is, I have no hesitation in saying, perfectly chimerical, and they might as well talk of making a voyage from New York or Liverpool to the moon." (Dr. Dionysius Lardner, author of Lardner's Encyclopedia, in a lecture at Liverpool, December, 1835.)

† Dissertationum De Novis Quibusdam Machinis, by Dionysis Papin, Marburg, 1695.

that Fitch, Rumsey, Stevens, Fulton, Livingston, Millar, Symington, and others conducted the experiments that have formed the basis of the claims for each, that he was the original inventor of the steamboat.

The history of steamboat invention since 1785 has been so frequently written, and the claims of the friends of these rival inventors have been so fully discussed, that it is not necessary to enter into the details of the controversies, which in past years were carried on with considerable ardor.

It will be of interest to review briefly, in chronological order, the events of importance in the history of steam navigation after,

> Jonathan Hulls,
> With his patent skulls,
> Invented a machine,
> To go against wind with steam;
> But he being an ass,
> Couldn't bring it to pass,
> And so was ashamed to be seen.*

The scope of this article requires that reference shall only be made to those inventors who, by drawings, models, or by the actual construction of machines, demonstrated that they had practical ideas.

In the "Annales des Arts et Manufactures," Paris, 1803, are several drawings† to illustrate a machine, contrived by Daniel Bournoulli, 1753, to drive "vanes" on each side of the vessel and in the stern "set at an angle of 60 degrees with the keel of the vessel." These, he says, "can be moved by men aboard the vessels or by steam-engines, or on rivers by horses placed in the barges."

In 1783 the Marquis de Jouffroy, whose labors in the latter part of the last century furnish the ground for the claim that the invention of the steamboat should properly be credited to the French nation, designed a steamboat 400 metres long, to contain a steam-engine with a horizontal cylinder geared by a rack to a shaft on which were paddle wheels.

A print of this boat, made by M. Jamont from the original drawing, is preserved in the English patent office library. It bears the title "Plan et Profil du Bateau a Vapeur, Execute par Marquis de Jouffroy a Lyon, 1783."

In the U. S. National Museum is preserved a portion of the chain-gearing of the machinery of a boat which was constructed by James Rumsey, and exhibited by him to Gen. George Washington, at Berkeley Springs, Virginia, in 1784. The certificate given to him by Washington, under date September 7, 1784, contains the statement "that the discovery is of vast importance and may be of the greatest usefulness in our inland navigation."

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* Doggerel sung by the boys of Campden in Gloucestershire, Hulls' native town. See Notes and Queries, vol. III, series 1.

† See Tome, XX p., 329.

Admiral Preble, in his valuable "History of Steam Navagation," states that, "the boiler and machinery for Rumsey's steamboat were made at the Catoctin Iron Furnace, in Frederick County, Maryland, then owned by Johnson Brothers."

Although Joseph Bramah, of London, took out a patent in May, 1785, for a vessel with a propeller in the stern, which he describes as "a wheel with inclined fans or wings, similar to the fly of the smoke-jack or the vertical sails of a windmill," an examination of the drawings attached to his patent shows clearly that he could not have put his invention into practice by working his wheels by steam.

To John Fitch, who from 1783 to 1791 experimented with steam on several boats in the vicinity of Philadelphia, the credit is due in constructing the first steamboat that carried passengers and merchandise for pay.

A copy of the Federal Gazette and Philadelphia Daily Advertiser, July 26, 1790, is preserved in the U. S. National Museum, and contains the following advertisement:

THE

STEAMBOAT

Sets out to-morrow morning, at ten o'clock, from Arch-street ferry, in order to take passengers for Burlington, Bristol, Bordentown, and Trenton, and return next day.
Philad., July 26, 1790.

Under date of August 26, 1791, the first patents issued by the Government of the United States for steamboats were issued simultaneously to John Fitch, Nathan Read, James Rumsey, and John Stevens.

Read had as early as 1789 exhibited to a committee of the American Academy of Arts and Sciences a model of his steamboat with paddle wheels, which he designed to connect with a high-pressure engine.

John Stevens's experiments took a wider range than those of any of his predecessors, and embraced both the paddle wheel and the screw propeller.

His ideas were not visionary or chimerical, and he finally reduced them to practice. Although he, in common with all other projectors, suffered on account of not being able to obtain the services of competent workmen, he succeeded in practically applying steam to the propeller. The original engine which he designed and constructed (1804), was the first steam engine to drive a screw propeller successfully, and is preserved in the museum of the Stevens Institute, at Hoboken, New Jersey.

During the last years of the eighteenth century many experimental steamboats were constructed on both sides of the water. The more worthy of note were those built by Elijah Ormsbee and Samuel Morley, both citizens of Connecticut, in 1794, and by Chancellor Livingston, who, in 1797, assisted by the elder Brunell, afterwards engineer of the Thames Tunnel, built a steamboat on the Hudson, which was partially successful.

During the early years of the present century invention was very active.

The improvements in the stationary engine had been carried forward so rapidly as to give great hope to those whose dream it was to drive a boat surely and safely against wind and tide.

Symington was experimenting on the Forth and Clyde Canal in England in 1802. In 1803 Fulton launched his experimental steamboat, built on a large scale, on the Seine below Paris. In 1804 John Stevens propelled his boat, driven by twin-screws geared to a steam-engine, from the battery in New York across the Hudson River to Castle Point, Hoboken, at a speed of six miles an hour, and in 1806 he constructed a pirogue fifty feet long, which developed considerable speed.

But all these attempts may be regarded as experiments—more or less successful—for it was not until 1807 that the success of Fulton with the *Clermont* and John Stevens with the *Phœnix* demonstrated to American capitalists that the steam-engine could be practically and economically applied to navigation.

Bell, who followed a few months later, was equally successful in English waters.

## EARLY STEAM VESSELS.

The news of Fulton's success on the Hudson soon spread to all parts of the globe and attracted the attention of men in every department of public life.

Statesmen saw that the invention would revolutionize commerce, while it foreshadowed great possibilities for national development. Soldiers and sailors knew that the sailing frigate must soon be replaced by a craft driven by steam-power, and that new modes of warfare must shortly follow the introduction of the steamboat on inland waters.

New water routes not hitherto navigable by sailing vessels were speedily opened and capital sought investment in steamboat property.

In 1809 the first steamboat on the St. Lawrence was launched; this was followed by a second in 1813.

In 1811 the *New Orleans* the first steamboat for service on Western waters was launched at Pittsburgh.

In 1812 the *Comet*, the first steamboat on the Clyde, was launched, and, strangely enough, a steamboat was built in Batavia the same year for use in India.

In 1813 a steamer was launched at Manchester, and another at Bristol.

In March, 1814, the Congress of the United States passed a law authorizing the President to cause to be equipped "one or more steam floating batteries for the defense of the waters of the United States," and on October 18 of the same year the first war steamship, designed by

Fulton and bearing his name, was launched at Brown's ship-yard in New York City.

In 1815 the pioneer of the fleet of steamers, soon after built to run between Liverpool and various ports of the English, Irish, and Scotch coasts, was launched on the Clyde, arriving safely in the Mersey, after calling at the Isle of Man. This was followed by several other boats for the same service during the next three or four years.

In 1815 there were five steamers on the Thames. By 1816 eight steamboats had been built to run on the Hudson and five or six on the Delaware.

In 1817 the first steamboat ran from New York to Newport, and the same year the first steamboat was put in service in Boston Harbor.

In 1818 steam navigation was inaugurated on Lake Erie, and in the same year the first steamboat was launched in Russia and steam tugboats were introduced on the Mersey.

This was the condition of steam navigation when the *Savannah*, the first ship equipped to be driven across the Atlantic by steam, stood upon the stocks at New York, in August, 1818, waiting to be launched.

## THE OCEAN NAVIGATED BY STEAM.

It is conceded by all writers familiar with the subject that the *Phœnix*, built by Robert L. Stevens in conjunction with his father John Stevens, of Hoboken, New Jersey, was the first steam vessel to brave the dangers of the ocean.* This was in 1808, when the vessel went around from New York to Philadelphia by sea, navigating the Atlantic from Sandy Hook to Cape May. This boat did service on the Delaware River for many years, being an important link in the route from Philadelphia to New York.

## THE STEAMSHIP "SAVANNAH."

The *Savannah* was a full-rigged ship of 350 tons burthen and was built at Corlear's Hook, New York, by Francis Fickett. At first she was intended to be used as a sailing packet between New York and Havre, France. The keel was laid in 1818, and the vessel was launched August 22 of the same year.

While the *Savannah* stood upon the stocks she attracted the attention of Capt. Moses Rogers, who had been associated with Fulton and Stevens in commanding several of the early steamboats. It was through his exertions that Scarborough & Isaacs, a wealthy shipping firm in Savannah, were induced to purchase the vessel and fit her with engines with a view of giving to that city, which was then one of the most important American seaports, the credit of being the first to inaugurate a transatlantic steamship line.

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* Scott Russell thus alludes to this event: "Robert L. Stevens is probably the man to whom, of all others, America owes the greatest share of its present highly improved steam navigation. His father was associated with Livingston in his experiments previous to the connection of the latter with Fulton, and persevered in his experiments during Livingston's absence in France. Undisputedly he is the pioneer of steam navigation on the open seas."

The *Savannah* was equipped with one inclined, direct-acting, low-pressure engine of 90 horse-power, the diameter of the cylinder being forty inches and the stroke five feet. Her engine was built by Stephen Vail* at Speedwell Iron Works, near Morristown, New Jersey. The boilers were built at Elizabeth, New Jersey, by Daniel Dod. The paddle side wheels consisted of eight radial arms, held in place by one flange, and were arranged to close together like a fan. They were furnished with a series of joints so that they could be detached from the shaft and taken in on deck when storm or other circumstances required it. Her shaft had a peculiar joint at each end arranged for the purpose. The wheelhouse was made of canvas, stretched over an iron rim. It is unfortunate that no detailed drawing or accurate description of the wheel or machinery is in existence. The vessel carried seventy-five tons of coal and twenty-five cords of wood. The total cost was about $50,000, including engines and all rigging.

An account book containing a record of the original charges made against the *Savannah* for machinery, etc., by the proprietors of the Speedwell Iron Works, is now in the possession of Mr. John Lidgerwood, of No. 26 Liberty street, New York City.

I had the privilege of examining this interesting relic a short time since. The following is a transcript of the account:

*Steam Ship of Savannah, Dr.*

| | | |
|---|---|---|
| 1818. | | |
| August 1 | To paid Enos Bonnel 8 dollars for carting a cellender from E. Town | 8.00 |
| 27 | To boaring a 40-inch cillender, 5 feet 5 inches into it, and it proved bad, and casting of sinking head, $100-00 | 100.00 |
| October 28 | To paid carman three dollars for carting the air pump from E. Town | 3.00 |
| Nov'br 6 | To two lbs. of candles at 1*s*. 8*d* | .4[illegible] |
| 5 | To one peston rod, at 420 lbs. before it was turned, at 1*s*. 6*d*., 18c | 7[illegible] |
| | One air-pump rod at 205 lbs. before it was turned at 1*s*. 6*d* | 38.44 |
| 11 | To boaring a 40⅜-inch cellinder, 5-foot stroke at 4,200, 3 hundred at, say, 4707, at 5c | 235.35 |
| 17 | To boaring one air pump 5-foot stroke, at 17, 2, at, say, 1,974 lbs. at 5c | 98.70 |
| | To one load of pine stuff for patrons as per bill, $14, 12½ carting, $3 | 17.1[illegible] |
| | To lengthening the peston rod with 98 pounds of iron after it was part turned there being a mistake in the draft that Mr. Dod had made and submitted to me, $22.37½ | 22.3[illegible] |
| | Lengthening air-pump rod as the peston rod 8 inches with 30 pounds of iron and work to do it $8.62½ | 8.62 |
| 22 | To carting air pump to E. Town | 3.00 |
| | To one patron the pillow block to rest on, on the outside of the ship | 15.00 |
| | One large pillow-block patron | 10.00 |
| | One brass patron for do | 2.50 |
| | To Wm. Daglish, 2 days with patrons for the ship at 24*s* | 6.00 |
| | Carting patrons to E. Town poin t | 2.[illegible] |
| | To paid for carting 2 centers from Dod's and 12 flanges for the water wheels | 10.[illegible] |

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*Afterwards distinguished for his connection with Morse in the invention of the telegraph.

*Steam Ship of Savannah, Dr.*—Continued.

| | | | |
|---|---|---|---|
| 1818. | | | |
| De'ber | 2 | To 6 peston bolts and nuts, at 38 lbs. at 1*s*. 6*d* | $7.12 |
| | | To one crosshead, at 602, 1*s*. 6*d* | 112.88 |
| | | To one center patron for wheels with the core boxes made of your stuff (Deglish, 10 days, at 20*s*.; Soul Greenesen, 9 days, at 16*s*.) | 43.00 |
| | | To carting patrons to E. Town | 1.50 |
| | 4 | To one stuffing-box patron | 2.00 |
| | 7 | To turning crosshead by Egleston 2 days | 8.00 |
| | | | $838.35 |

*Capt'n Moses Rogers, Cr.*

| | | | |
|---|---|---|---|
| 1818. | | | |
| | | Steamship Dr. bro't up | |
| De'ber | 2 | Amount bro't up from page 13 | $838.35 |
| | | To turning peston rod a draw filung | 25.00 |
| | | Do air-pump rod | 15.00 |
| | | To drilling cellender head on flange | 3.00 |
| | | To drilling peston for the boult of the cover. 6 holes, 4½ deep, 1½ diameter of hard iron (done by Shomen & Noah) | 6.00 |
| | | To morticeing socket for peston | 3.00 |
| | | To reaming and fitting holes in cover | 2.50 |
| | | To reaming peston socket | 2.50 |
| | | To chipping boxes and fitting the nuts to peston and tapping them and cutting the boults | 6.00 |
| | | To one rist for crank turned the length of it, out 101 lbs., at 2*s* | 25.25 |
| | 6 | To 52½-inch boults, 389 lbs., 20 cents | 77.80 |
| | | 16 large boults for water-wheel arms, at 331 lbs., at 20 cents | 66.20 |
| | 12 | To 42 water-wheel arms, at 5,934 lbs., at 20 cents, at $1,186.80 | 1,186.80 |
| | 16 | To 1 lb. of candles, at 1*s*. 8*d* | .20 |
| | | 4 nail casks at 37½ cents | 1.50 |
| | | Carting and freight of 2-2-0 of cement, at 2*s* | .02½ |
| | 26 | To one socket for air pump peston rod, at 65, at 2*s* | 16.25 |
| | | To one strap on crosshead to peston rod, at 56, at 3*s* | 21.00 |
| | | To aultering the boults for water wheel armes, $10-00 | 10.00 |
| 1819. | | | |
| Jan'y | 2 | To 7 pair of smith's tongs, at 10*s* | 2.75 |
| | | 2 hand hammers, at 10*s* | 2.50 |
| | | 2 hand punches, at 6*s* | 1.50 |
| | | | 2,320.23 |

*Steam Ship of Savannah, Dr.*

| | | |
|---|---|---|
| 1819. | | |
| Jan'y 2 | Brought over | [illegible] |
| | To one large brace for drilling | [illegible] |
| | One set-hamer | [illegible] |
| | Two splething chisells, at 6*s* | [illegible] |
| | One tail-screw for drill | [illegible] |
| | 81 lbs. of links and hooks, at 1*s*. 6*d* | [illegible] |
| | 8 large screw boults for to hold down pedestells, at 64 at 2*s* | [illegible] |
| | 4 gibs and one knee for piston rods, at 6*s* | [illegible] |
| | 1 chipping hamer | [illegible] |
| | One sledge at 13 lbs., at 1*s*. 6*d* | [illegible] |
| | 1 chalk line | [illegible] |
| | 1 iron square, 4*s*., one steel do 8*s* | [illegible] |
| | Paid carman and freight of tools | [illegible] |
| | To David Shanon, 10 days at fitting brasses, knees to connecting-rod, at 18*s* | [illegible] |
| | Files and chisels for do., 40*s* | [illegible] |
| | Noah Johnson, 7 days at cutting screws and chipping as above, at 12*s* | [illegible] |
| | Dennis Dooley, 8 days at do., at 16*s* | [illegible] |
| | Robert Newell, 4 days at do., at 16*s* | [illegible] |
| | Wank, cutting screws, 4 days, at 12*s* | [illegible] |
| | Jabez Walsey, 7 days, cleaning castings, at 12*s* | [illegible] |
| | Jack, 6 days, cleaning, do., at 10*s* | [illegible] |
| | John N. Egelston, 4 days, at turning and fitting stuffing box and boults, at 16*s* | [illegible] |
| | To ½ a chaldron of coals to work for the ship in N. York—$8.25 | [illegible] |
| | To 10 bushels had by Capt'n Rodgers at E. Town, at 4*s* | [illegible] |
| | To one bush. patrons | [illegible] |
| 23 | To 8 screw swifells for water wheels arms at $10.00 | [illegible] |
| | One vacuum gauge | [illegible] |
| | One steam gauge | [illegible] |
| | 6 screw boults and nuts for piston cover boults turned at 37 lbs., at 2*s*. 6*d* | [illegible] |
| | 12 cellender cover boults and nuts (boults turned) at 31 lbs., at 2*s*. 6*d* | [illegible] |
| | 2 socket wrenches at 21 lbs., at 2*s*. | [illegible] |
| | 2 slat boults for stuffing box of Hollanders turned at 15 lb., at 2*s*. 6*d*. | [illegible] |
| | One long pair of stocks, taps, and dies complete | [illegible] |
| | One less do. with taps and dies | [illegible] |
| | | [illegible] |

*Steam Ship of Savannah, Dr.*

| | | |
|---|---|---|
| 1819. | Bro't up from opposite page | [illegible] |
| Jan. 29 | To one half chaldron of coals of Vambusing, at $16.50 | [illegible] |
| | To one key to carry boultes | [illegible] |
| Feb. 4 | To Samuel Carson 10 days at drawing and other things, at $4 | [illegible] |
| | To 8 gauge cocks, at 12*s* | [illegible] |
| | 2 oil cocks, at 24*s* | [illegible] |
| 17 | To p'd Shubal Trowbridge for sundry casting to Speedwell from El'z'thtown and from Speedwell to E. town | [illegible] |
| | To do for do, do, do tons 4. 7. 3. 18, at $3 | [illegible] |
| | To 1 connecting rod, wt. 968 lbs., at 27 | [illegible] |
| | To 40 screw bolts, at 4*s* | [illegible] |
| | To 40 clasps with double nuts, at 6*s* | [illegible] |
| | To 1 nail cog, 3*s* | [illegible] |
| | | [illegible] |
| | Add error | [illegible] |
| | | [illegible] |

## *Steam Ship of Savannah, Dr.*—Continued.

| | | | |
|---|---|---|---|
| 1819.<br>Feb. 25 | To 44 days' work by David Shannen, blacksmithing in N. York for the ship, at 15s | | $82.50 |
| | To 34 days, by Ira Arnold, blacksmithing in N. York for the ship, at 12s | | 51.00 |
| | To 49¾ days, by William Daglish, on board the ship, at 18s | | 111.94 |
| | To 38 days, by Marvin Nugent, on board the ship, at 14s | | 66.50 |
| | To 2½ chaldron coal of Van Bussing, in New York | | 16.50 |
| | To freight of cillender p. corells boat | | 5.00 |
| | To cartage by Dalglish | | .50 |
| | To sundries from I. G. Purson & Brothers, amt. viz: | | |
| 1819.<br>Jan. 6 | 20 lbs. cast steel, at 2s. 3d | 5.63 | |
| 11 | 1. 0. 10 iron, 40s | 5.45 | |
| | 1. 3. 5 do, 48s | 10.77 | |
| | Steel | 2.27 | |
| 27 | 4. 1. 14 iron, 40s | 21.88 | |
| | 13 lbs. cast steel, 2s. 3d | 3.66 | |
| Feb'y 1 | 8. 0. 4 iron, 40s | 40.18 | |
| | 1. 1. 10 do, 42s | 7.31 | |
| 20 | 3. 1. 7 round iron do, 42s | 17.40 | |
| | | | 114.55 |
| | To 6 days by Noah Johnson in New York | | 9.00 |
| | | | $3,521.71 |

## *Dr. Steam Ship of Savannah.*

| | | | |
|---|---|---|---|
| | To am't brought over | | $3,521.71 |
| | Deduct carting of sundries charge in this acc't which is not yet done | | 20.12 |
| | Carting $20.12 not included. | | $3,501.59 |
| March 28 | To 26 days' work done by D. Shonen, at 15s | | 48.75 |
| | 16 days' work done by I. Arnold, at 12s | | 24.00 |
| | Paid carman for riding iron, &c | | 3.12½ |
| | 40 doubled boults for paddles, at 6s | | 30.00 |
| | Box for do and cartage | | 1.00 |
| | 2 1.18 of iron at 40s., had March 4th | 12.40 | |
| | 3.17 of D rd, 48s | 5.41 | |
| | | | 17.45 |
| | 2 2.28 of Do id 48s., had March 13th | 10.18 | |
| | Cartage of the last to ship | .63 | |
| | | | 10.81 |
| | This iron was had of J. G. Persons & Brothers. | | |
| | To paid Benjamin Sofield for carting from white hall to the steamship, 25s | | 3.12½ |
| | To paid Wm. Dalglish for carting one load of patrons to yards in Dublin | | .62½ |
| | To 18 days' work done by Wm. Dalglish on board of the steamship at Elizabeth town, in December, 1818, and omitted in my ac. rendered in February, at 18s | | 40.50 |
| | To ½ chaldron of coals, and carting had of John Vanbusting, 1s | | 7.75 |
| May 4 | To paid James P. Allaire for sundries p. bill p. order of Capt. Rodgers | | 15.78 |
| | | | $202.91½ |

## *Contra, Cr.*

| | | |
|---|---|---|
| 1819.<br>Feb. 26 | By Pott & McKinnies note, at 60 days | $1,750.80 |
| | Do. do. at 90 days | 1,777.04 |
| | In full p. rec't when paid | $3,527.84 |
| | Deduct for discount | 26.25 |
| | | $3,501.59 |

In addition to the engines the vessel carried the same complement of spars and sails as a sailing ship of that period, with the exception of royal-masts and royals.* The hull and rigging were constructed under the direction of Stevens Rogers, afterwards sailing master of the vessel.

The most important difference noticeable in her rig, so far as can be determined by engravings extant, is that her mainmast stood considerably farther aft than it would have been placed on a ship intended to be propelled only by sails. This modification of the rig was doubtless made to obtain more space between the foremast and the mainmast, so that the boilers, engines, and coal bunkers could be located nearly in the middle of the ship and still be forward of the mainmast.

The cabin space was divided into three saloons, handsomely furnished with imported carpets, curtains, and hangings, and decorated with mirrors.

The state rooms were large and commodious; the interior effect of the decorations resembling those of a pleasure yacht more than a steam packet. After the vessel was launched there was considerable delay in completing the engines and machinery, which were of unusual size. Several boilers were discarded before one was found that would stand the tests made by Capt. Moses Rogers, and it was not until very late in the winter of 1818-'19 that the machinery was in working order.

### TRIAL TRIP.

The New York Mercantile Advertiser, March 27, 1819, contains the following:

> By an advertisement in this day's paper it will be seen that the new and elegant steamship *Savannah* is to leave our harbor to-morrow. Who would have had the courage 20 years ago to hazard a prediction that in the year 1819 a ship of 300 tons burden would be built in the port of New York to navigate the Atlantic propelled by steam? Such, however, is the fact. With admiring hundreds have we repeatedly viewed this prodigy, and can also bear witness to the wonderful celerity with which she is moved through the water. On Monday last a trial was made of her speed, and although there was at no time more than an inch of steam upon her, and for the greater part only a half inch, with a strong wind and tide ahead, she went within a mile of the anchoring ground at Staten Island and returned to Fly Market Wharf in 1 hour and 50 minutes. When it is considered that she is calculated to bear 20 inches of steam and that her machinery is entirely new, it must be evident that she will with ease pass any of the steamboats upon our waters.
>
> Her cabin is finished in elegant style and is fitted up in the most tasty manner. There are thirty-two berths, all of which are state rooms. The cabin for ladies is entirely distinct from that intended for gentlemen, and is admirably calculated to afford that retirement which is so rarely found on board of passenger ships.

### THE OFFICERS AND CREW OF THE SAVANNAH.

Moses Rogers, the captain (Pl. CLII), and Stevens Rogers, the first officer (or sailing-master, as he was called), although bearing the same surname, were not related by ties of blood. They were, however, brothers-in-law, the latter having married a sister of the former.

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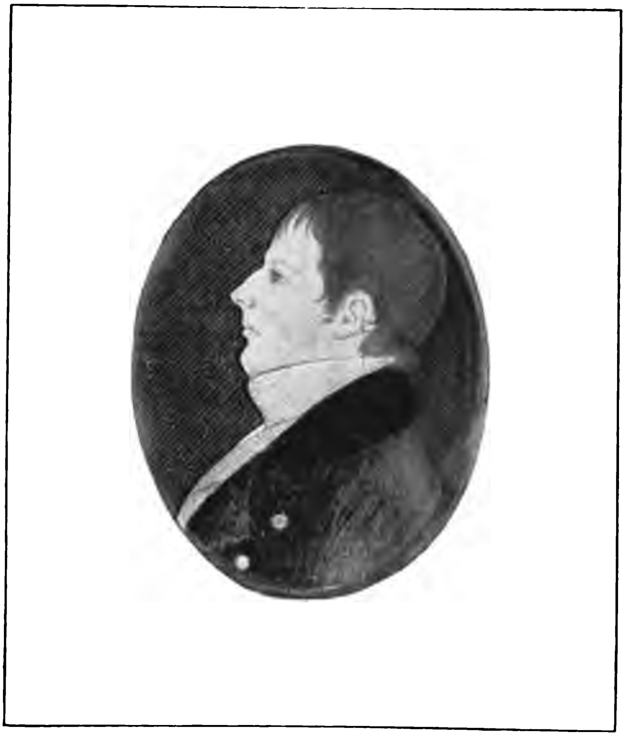
* See explanatory note by Captain Collins on p. 611.



MOSES ROGERS, CAPTAIN OF THE SAVANNAH.

(From the miniature in the possession of the U. S. National Museum, made in his twenty-second year, at New London, Connecticut.)

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This plate should be inserted as Plate CLI*a* opposite page 622 in th paper entitled "Log of the *Savannah*," in the Report of the Nationa Museum for 1890. The legend accompanying Plate CLII should b changed to read "Stevens Rogers, sailing-master of the *Savannah*," and the statement in regard to the source of the photograph should b omitted.

MOSES ROGERS, CAPTAIN OF THE SAVANNAH.

(From a photograph of the miniature made in Russia in 1819, while the vessel was in the port of St. Petersburgh.)

The experiment of crossing the ocean in a steam vessel was deemed so hazardous that no crew could be shipped in New York Harbor, where it was predicted that the vessel would be a "steam coffin;" and sailing-master Rogers was compelled to visit New London, Connecticut, where he was only able to obtain a crew from the fact that both the captain and sailing-master were well known to many seafaring men of that locality, who had confidence in their ability to command and navigate the ship successfully.

### MOSES ROGERS, CAPTAIN OF THE SAVANNAH.

Moses Rogers was born in New London, Connecticut, in 1779. From his early boyhood he showed great fondness for boats and ships, and had learned to manage a sailboat at a very early age. When he was twenty-one years old he commanded a sailing packet on Long Island Sound, and five years later he became interested in the experiments of Fulton and Stevens, who were each then building steamboats. It has been frequently stated that he commanded the *Clermont*, the first successful steamboat on the Hudson, but the many published accounts of the early voyages of that celebrated steamboat contain no mention of his name. But during the eventful career of this boat she was commanded by several captains, and it is not improbable that Mr. Fulton availed himself of his services, at least for a time.

In 1808 he commanded the *Phœnix*, built by John Stevens and his son, Robert Livingston Stevens, when it made the memorable voyage from Sandy Hook to Cape May, on its way from New York to Philadelphia. This was the first time that a steam vessel ever braved the dangers of the ocean.

In the handsome oil painting of the *Phœnix*, which is now preserved n the private gallery of the late Edwin A. Stevens, a brother of Robert L. Stevens, at Castle Point, Hoboken, New Jersey, the name *Moses Rogers* is painted in bold letters across the paddle box. This custom was not uncommon in the early days when the name of the captain was as well known as that of the craft he commanded.

In 1813 Moses Rogers commanded the *Eagle* on her first voyage beween New York and Baltimore, and he was associated with the owners f the *New Jersey* in 1816, when regular biweekly voyages were inaugurated between those ports.

Captain Rogers was a man whose opinions were sought by steamboat wners and constructors. He was highly respected by the traveling ublic, whose entire confidence he possessed. The executive ability which he displayed while in command of his vessels made him greatly admired by those who trusted their lives in his hands. The tact which e exhibited while in foreign ports made him popular with all classes. During his cruise in foreign waters he was the recipient of many valable presents. The King of Sweden gave him "a stone and muller."

The Emperor of Russia presented him with a gold watch,* which is referred to as "three times as big as common watches and an excellent timekeeper."

While the *Savannah* was lying at Stockholm, Captain Rogers made the acquaintance of Lord Lynedock,† a British nobleman, who accompanied him in his voyage to St. Petersburg.

During the voyage Lord Lynedock was so much pleased to find that only fifteen minutes was required to bring the vessel from steam to canvas that he exclaimed, "I blame no man born in the United States for being proud of his country; were I a young man I'd go there myself."

At the end of the voyage he presented Captain Rogers with a massive solid silver coffee urn (Pl. CLIII), bearing the inscription:

Presented to Captain Moses Rogers
of the Steamship Savannah,
Being the first steam vessel
That had crossed the Atlantic
By
Sir Thomas Graham, Lord Lynedock,
A Passenger from Stockholm to
St. Petersburgh,
Sept. 15, 1819.

This kettle has been carefully preserved by the descendants of Captain Rogers, who have recently deposited it in the U. S. National Museum.

From the 28th of March, 1819, when the *Savannah* left the port of New York, until the 16th of December of the same year, when the vessel after visiting many foreign ports returned to Washington, Captain Rogers was in constant command. It was his boast that during this voyage of many thousand miles, "neither screw, bolt, nor rope yarn parted, although he experienced very rough weather." Owing to circumstances related elsewhere his connection with the *Savannah* ceased early in 1820, when he immediately formed a connection with the company operating the steamboat line plying between Georgetown, South Carolina, and Cheraw. He superintended the construction of the *Pee Dee* in 1820, and while in command of her died at Georgetown, South Carolina, October 15, 1821, aged forty-two years. The Georgetown "Intelligencer" contained the following obituary notice:

> Departed this life on Thursday, the 15th instant (October, 1821), in Georgetown, South Carolina, Capt. Moses Rogers, a native of New London, Connecticut, aged about 42 years. His remains were committed to the tomb in the burial ground of the Baptist church, attended by a large concourse of citizens of the town and neighbor-

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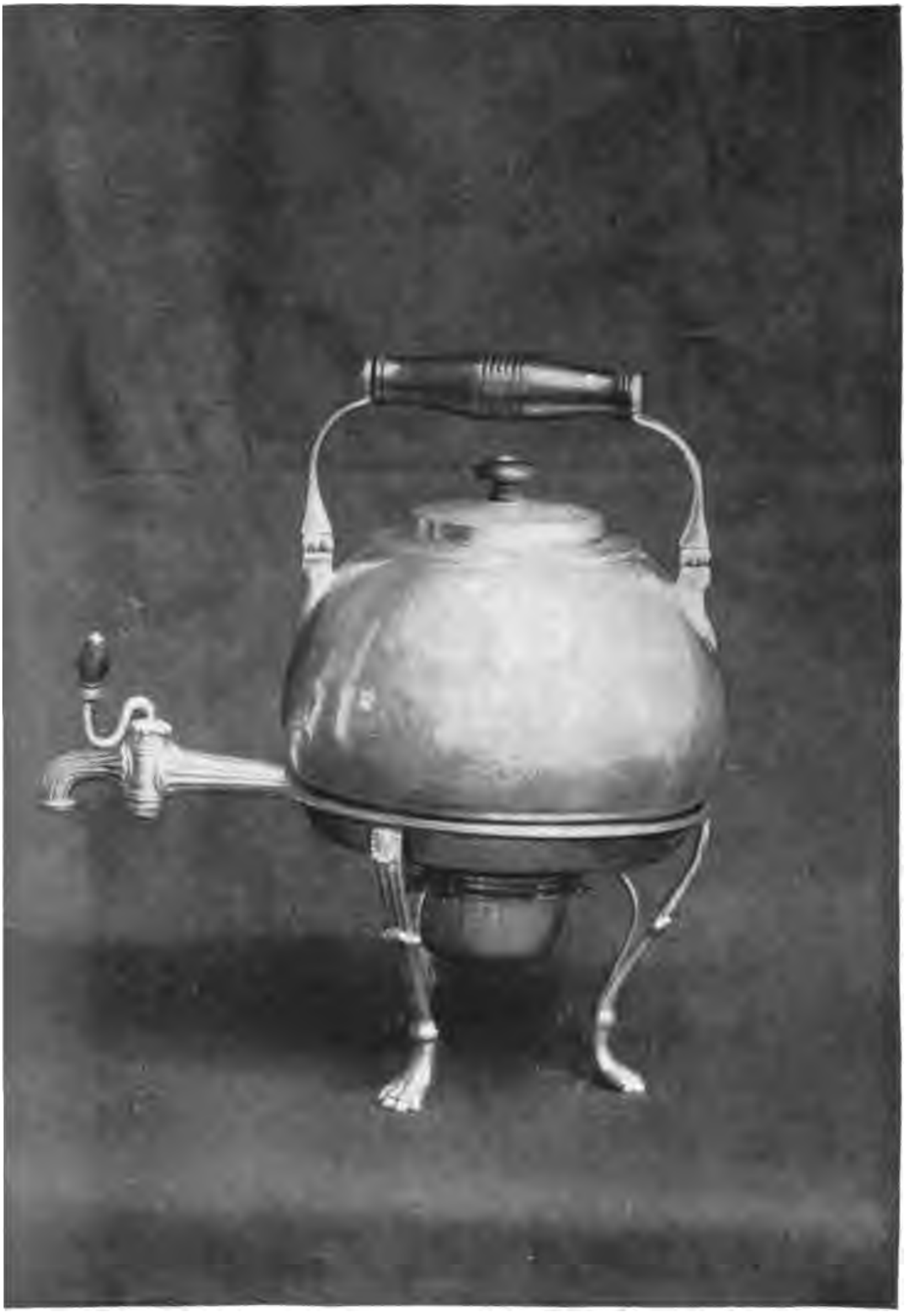
[*] Some years ago a Southern paper made the statement that this watch was in the possession of Mr. Buhler, of West Baton Rouge, Louisiana.

[†] Thomas Graham, Lord Lynedock, was born in Perthshire, England, 1749. Entered the British army 1780. Rose to the rank of general. Served under Sir John Moore. Commanded at the battle of Baropa, 1811, and at the battle of Varuna. In 1813 took San Sabastian. Raised to the peerage 1819. Died 1843.



SOLID SILVER COFFEE URN.

(Presented to Capt. Moses Rogers, September 15, 1819, by Sir Thomas Graham, Lord Lynedock, who was a passenger on the Savannah during the voyage from Stockholm to St. Petersburgh.)

hood, who were anxious to pay this last sad tribute to the memory of one whose death they esteem a public loss.

Captain Rogers was for some time actively and usefully engaged on the North River in the earliest experiments which were made in the application of steam to the purposes of navigation. He afterwards commanded the steamship *Savannah*, the first steam vessel, we believe, that ever navigated the ocean, and certainly the only one which ever crossed the Atlantic. The *Savannah*, under the direction of this skillful and enterprising commander, passed in perfect safety to England and from thence to Stockholm and St. Petersburgh and back to the United States, thus fully demonstrating the benefits which might arise from the application of steam to the general purposes of maritime navigation. In 1820 he was engaged by a respectable company to take charge of the steamboat *Pee Dee*, which plies between this town and Cheraw. That he fully and satisfactorily performed the duties incumbent on him in this station the universal grief which pervades our community fully testifies.

Captain Rogers had lately returned from a visit to his family in Philadelphia, and was on his first voyage from Cheraw to this place when he was attacked by that fell disease (produced by his devotedness to his business) which has at once deprived society of an energetic, industrious, and enterprising citizen, and his family of an affectionate husband and most tender parent.

## STEVENS ROGERS, SAILING-MASTER OF THE SAVANNAH.

Stevens Rogers was born at New London, Connecticut, in 1789; he had been associated with Moses Rogers in the management of sailing vessels and steamboats before he was called upon to superintend the construction of the hull and to design the rigging of the *Savannah*, in 1818.

He rendered valuable assistance to Capt. Moses Rogers in the memorable voyages of the *Savannah*—every word of the record of which, in the log book, being in his handwriting.

He outlived almost all of his contemporaries, and during a long and busy life, which terminated only two days before the fiftieth anniversary of the date of the launch of the *Savannah*, he saw the transatlantic steamship service, in which he was a pioneer, thoroughly established.

Born soon after the close of the Revolution, he remembered the death and burial of Washington, and was acquainted with the sailing vessels in our Navy during the war of 1812. He saw the first steam war ship,* and lived to see all the navies of the world twice reconstructed: first, when steam power revolutionized naval architecture; and again, when iron armament was applied to battle ships.

He read the story of the conflict between the *Monitor* and *Merrimac*, and after living through three wars he saw his country finally at peace with itself and all the world—a peace which the ocean steamship has done more to perpetuate than all the standing armies of the universe.

The following newspaper notices of the events that brought his life to a close give evidence of the high estimation in which he was held during a lifetime of nearly four score years:

[New London Star, August 26, 1868.]

The funeral services of Capt. Stevens Rogers took place on Sunday afternoon. Union and Brainard Lodges, Free and Accepted Masons, escorted the remains from the residence of the deceased to the First Baptist Church, where the funeral sermon was preached by Rev. Mr. Burdick, of Westerly. The church was filled to its utmost capacity, and hundreds were unable to gain admittance. At the close of the exercises in the church the lid of the coffin was raised, and large numbers availed themselves of the opportunity to look for the last time upon the well-known features of the deceased. The funeral procession included the Masons to the number of 200, about 50 carriages, and several hundred on foot, among whom were many of our most prominent citizens. State street from the church to the court-house was lined with spectators. The remains were interred in Cedar Grove cemetery, and the beautiful Masonic service was performed at the grave under the direction of Rev. J. C. Waldo, chaplain of Union Lodge. An exceedingly interesting sketch of the life of Captain Rogers will be found elsewhere, over a signature well known to our readers.

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* *Fulton the first*, launched at New York, 29th Oct., 1814, "to mount 30 long 32-pounders and 2 100-pounders (Columbiads)."

## OBITUARY.*

Capt. Stevens Rogers, who died suddenly in this city August 20, 1868, deserves a more than casual notice from his contemporaries. A large part of his life was devoted to sea-faring pursuits, which he had followed in the various forms of coasting trade and ocean voyages, by sail and by steam, acquiring the reputation of a skillful and experienced navigator. His connection with the early attempts of ocean steam navigation demand for him an honorable place in the record of American seamanship.

He was born at New London (Great Neck), upon the border of Long Island Sound, February 13, 1789, and began at an early age to follow the seas. As if to seal himself for that business he had, when a young man, the figure of a ship stamped so indelibly upon his arm that even in his old age it had the distinct outline of a recent draft. He married the sister of Capt. Moses Rogers, of Groton, and was connected with that enterprising mariner in his various experimental steam excursions. He was with him in the *Phœnix*, which went from New York to Philadelphia in 1809; in the *Eagle*, which went to Baltimore in 1713, and in the *New Jersey* to Baltimore in 1816, all propelled by steam.

The voyage of the steamship *Savannah* from Savannah to Liverpool was made in 1819. This was the first attempt to cross the ocean by steam. Capt. Moses Rogers was the commander and Capt. Stevens Rogers was the sailing master.

The voyage was accomplished in 22 days, of which 14 were without the use of canvas, sails being used a portion of the time to save the consumption of fuel. When the vessel arrived off Cape Clear she was telegraphed to Liverpool as a vessel on fire, and a cutter was sent from Cork to her relief. Great was the surprise and admiration when the gallant ship entered the harbor of Liverpool under bare poles, belching forth smoke, yet uninjured.

From Liverpool the *Savannah* went to Copenhagen and through the Baltic Sea to Stockholm and St. Petersburg. At these places she was visited and admired and her crew feasted and praised by kings and nobles as well as the populace. The sailing master received almost as much notice and applause as the commander.

Lord Lyndock, an English nobleman, who was then on his travels in the north of Europe, took passage in the steamer from Stockholm to St. Petersburg, and was so well satisfied with the intelligence of the sailing master that he kept by his side for hours together conversing with him. Before parting he presented him with a gold snuffbox, chased and ornamented, with the following inscription engraved on the inside of the lid: "Presented by Sir Thomas Graham, Lord Lyndock, to Stevens Rogers, sailing master of the steamship *Savannah*, at St. Petersburg, October [illegible], 1818."

The return voyage of the *Savannah* occupied 25 days. Capt. Stevens Rogers afterwards commanded the brig *Park*, and subsequently was in the coasting line upon Long Island Sound. In 1850 he was appointed to office in the custom-house at New London as inspector, and still later for several years was collector of the city taxes.

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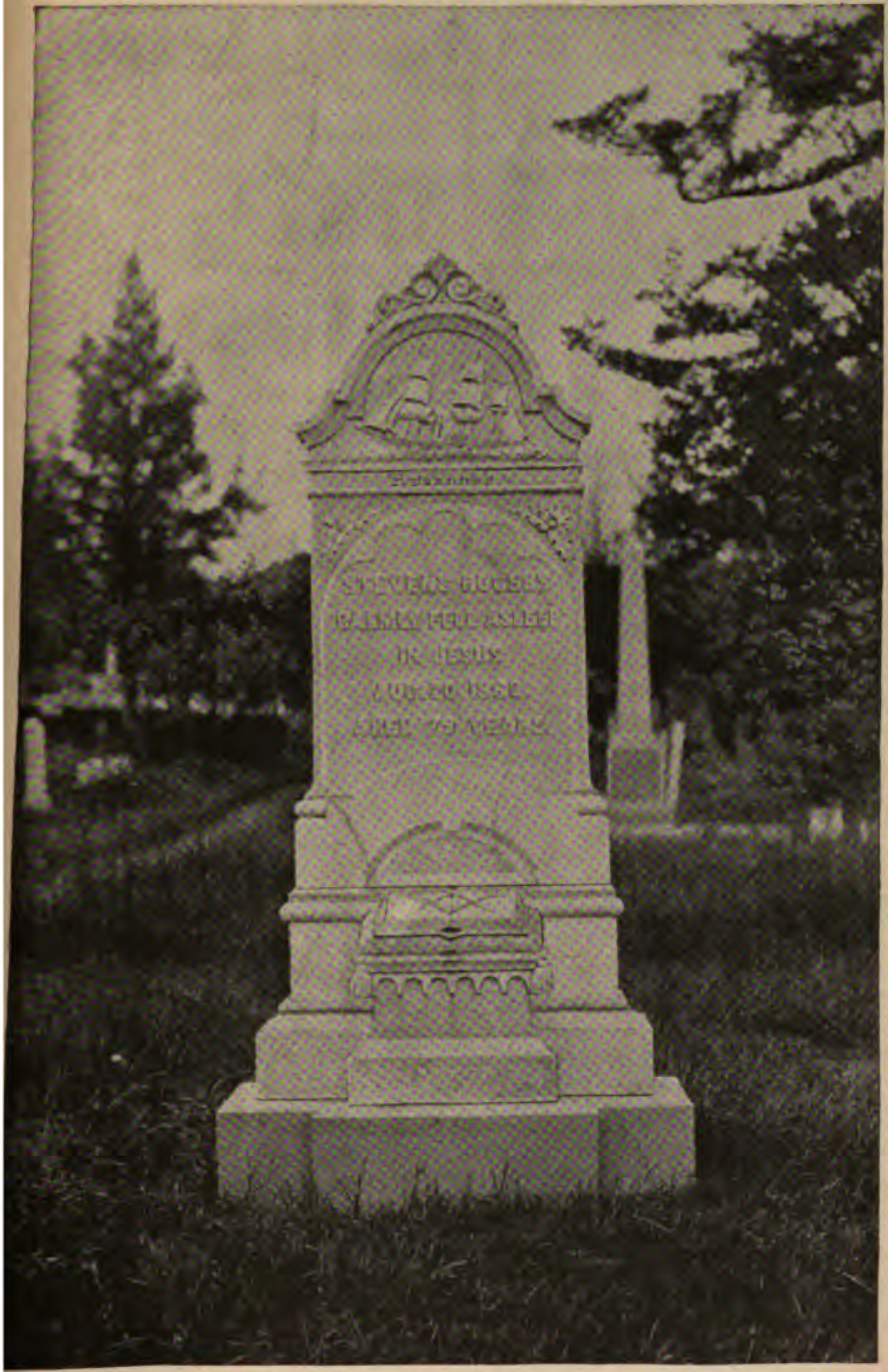
* For the Star of August 26, 1868.



MARBLE TOMBSTONE IN THE CEMETERY AT NEW LONDON, CONNECTICUT, TO THE MEMORY OF STEVENS ROGERS, SAILING MASTER OF THE SAVANNAH.

(The bas-relief is a representation of the vessel under steam.)

> He was one of the oldest Freemasons in the town, a devoted member of the fraternity, and always a conspicuous figure in the processions. The image of his stately form, clothed in the emblematic garb of the society, with the great Bible borne in his outspread hands, as at funerals and other Masonic exhibitions, will long dwell in the memory of many of our citizens. His funeral took place on the 23d instant. A long array of Masons accompanied the remains to the cemetery, with mournful music and evergreen memorials, testifying their respect for their departed brother.
>
> F. M. C.

Over his remains in the cemetry at New London a marble tombstone (Pl. CLIV) has been erected, containing on one side a representation in bas-relief of the *Savannah* under steam; upon the other is the following inscription:

> The voyage of the steamship *Savannah* from Savannah to Liverpool was made in 1819.
>
> This was the first attempt to cross the ocean by steam, Capt. Moses Rogers being commander and Capt. Stevens Rogers, his brother-in-law, navigator, both natives of New London.
>
> From Liverpool the *Savannah* went to Copenhagen, and through the Baltic Sea to Stockholm and St. Petersburg; at these places she was visited and admired by kings, nobles, and the people.
>
> Her machinery was constructed under the skillful direction of Capt. Moses Rogers, who was familiar and identified with Fulton. He died of yellow fever at Georgetown, South Carolina, November 15, 1822, aged 42 years.

The following is an extract from an account of the arrival of the *Savannah* in England that was communicated by Sailing Master Stevens Rogers to the "New London (Connecticut) Gazette," in 1838, after the inauguration of regular transatlantic steamship travel by the *Sirius* and *Great Western:*

> She was seen from the telegraph station at Cape Clear, on the southern coast of Ireland, and reported as a ship on fire. The admiral, who lay in the cove of Cork, dispatched one of the King's cutters to her relief. But great was their wonder at their inability, with all sail in a fast vessel, to come up with a ship under bare poles. After several shots were fired from the cutter the engine was stopped, and the surprise of her crew at the mistake they had made, as well as their curiosity to see the singular yankee craft, can be easily imagined. They asked permission to go on board, and were much gratified by the inspection of this naval novelty. On approaching Liverpool hundreds of people came off in boats to see her. She was compelled to lay outside the bar till the tide should serve for her to go in. During this time she had her colors all flying, when a boat from a British sloop-of-war came alongside and hailed. The sailing master was on deck at the time and answered. The officer of the boat asked him, "Where is your master?" to which he gave the laconic reply, "I have no master, sir." "Where's your captain, then?" "He's below; do you wish to see him?" "I do, sir." The captain, who was then below, on being called, asked what he wanted, to which he answered, "Why do you wear that penant, sir." "Because my country allows me to, sir." "My commander thinks it was done to insult him, and if you don't take it down he will send a force that will do it." Captain Rogers then exclaimed to the engineer, "Get the hot-water engine ready." Although there was no such machine on board the vessel, it had the desired effect, and John Bull was glad to paddle off as fast as possible. On approaching the city the shipping piers and roofs of houses were thronged with persons cheering the adventurous craft.

Several naval officers, noblemen, and merchants from London came down to visit her, and were very curious to ascertain her speed, destination, etc. As it was soon after Jerome Bonaparte had offered a large reward to anyone who would succeed in taking his brother from St. Helena, it was suspected that that was the object of the *Savannah.* After remaining 25 days in Liverpool, during which time she was visited by thousands of people of all rank, and her officers were treated with marked attention, she left for Copenhagen, at which place she arrived in safety, where she excited similar curiosity. She proceeded thence to Stockholm, in Sweden, where she was visited by the royal family, the foreign ministers, naval officers, the nobility, and others, who, by invitation of Mr. Hughes, the American minister, dined on board, and took an excursion among the neighboring islands, with which they were much delighted.

Lord Lyndock, of England, who was then on a tour through the north of Europe, by invitation of our minister took passage on board of the *Savannah* for St. Petersburg, which place she reached in due time. Here she was visited, by the invitation of our minister at that court, by several noblemen and military and naval officers, who also tested her superior qualities by a trip to Cronstadt. Her officers received several valuable presents of plate, etc., and we have now before us a superb gold snuffbox, which was presented to her sailing master, Capt. Stevens Rogers, by Lord Lyndock. She sailed from St. Petersburg to Copenhagen, and then to Arendal, in Norway, whence she returned to Savannah, where, after a passage of about 25 days, she arrived in safety—being the first steam vessel that ever crossed the Atlantic—and after performing a voyage highly creditable to American ingenuity and enterprise.

She used Liverpool coal for fuel, of which she took 75 tons, as well as 25 cords of wood for kindling. She had no freight, and only used her engine when not able to go at the rate of 4 knots with her sails. By the great fire in Savannah her owners were compelled to sell her, and she was purchased to run as a packet between that place and New York, whither she was bound, under charge of Capt. Nathaniel Holdredge, now master of the Liverpool packet ship *United States*, when she was lost on the south side of Long Island.

A more detailed account of the voyages is given in the notes from the log book, which follows:

## NOTES FROM THE LOG BOOK OF THE SAVANNAH AND THE NEWSPAPERS OF THE DAY.

The log book of the *Savannah* (Pl. CLV) is composed of twenty-four sheets of thick brown paper, eleven inches by fourteen, stitched through and through the middle fold, and attached to a coarse cover of sail-cloth bearing the inscription:

STEAMSHIP
SAVANNAH'S
LOG BOOK.

Only fifty-two of the ninety-six pages are written upon. A fac-simile of two of them is shown in Pl. CLVI.

### I.—VOYAGE FROM NEW YORK TO SAVANNAH, GEORGIA.

We find that the vessel "got under way for sea with the crew on board" at 10 a. m.,* Sunday, March 28, 1819, and that the pilot left the ship off Sandy Hook Light three hours later, "with fresh breezes at NW."

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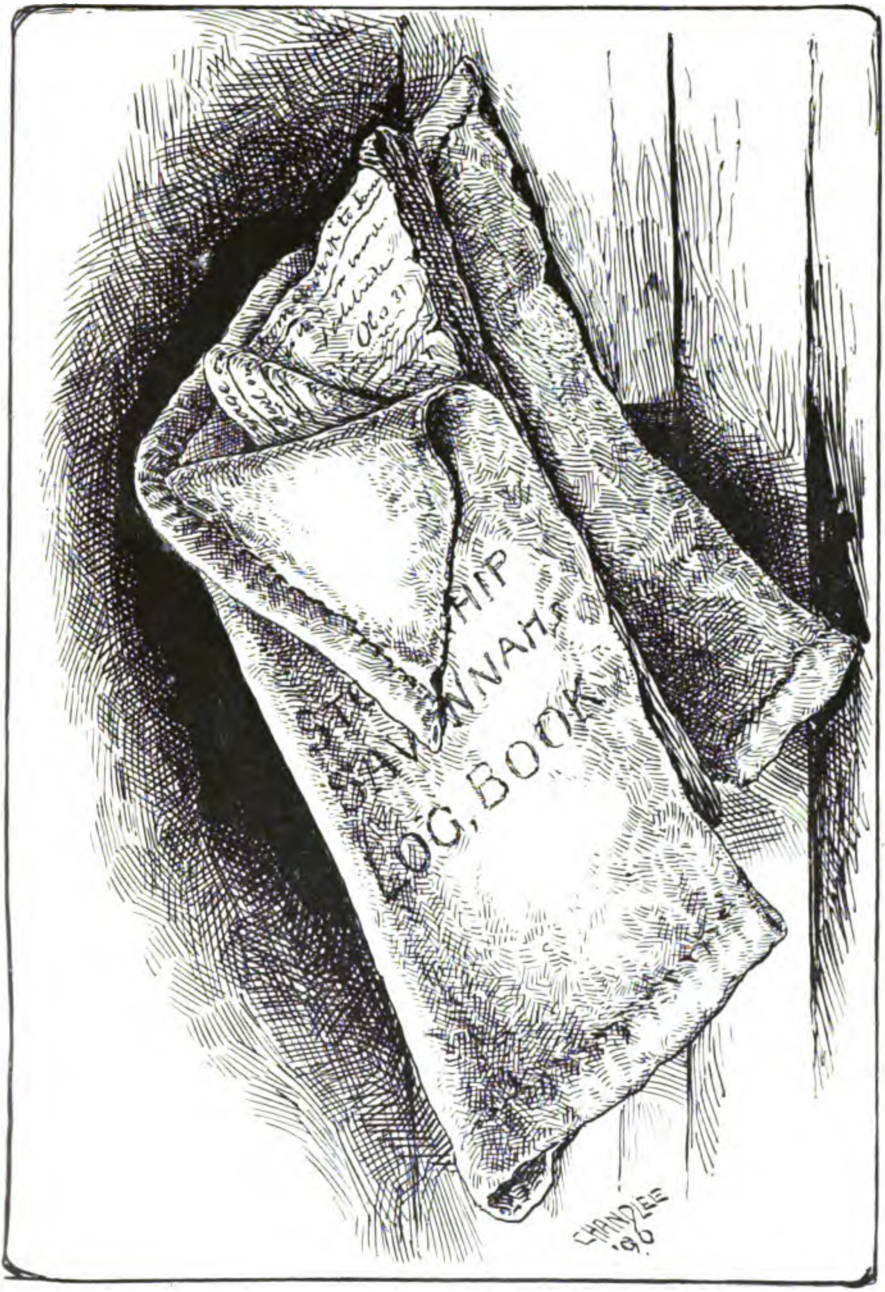
*It should be remembered that sea time begins 12 hours later than calendar time. On shipboard the log is kept by calendar time in port and by sea time at sea.

PLATE CLV.



LOG BOOK OF THE SAVANNAH.

(Drawn from the original, deposited in the U. S. National Museum.)

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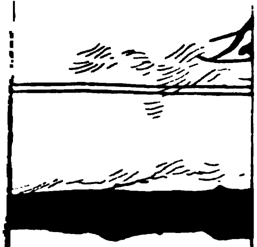

RS, SAILING MASTER.

As nothing is said about getting up steam it is assumed that the sails only were used. At 4 p. m. Sailing Master Rogers states, "with fresh breezes and clear" the "Hilands of Never Sink bore N. b. W. 6 leagues distant, from which I take my departure." Thus, seventy-two years ago, the sailing master of the pioneer transatlantic steamship, with a little crew of daring seamen, made the first record in a vessel's log book of the day and hour when he last saw land in New York Harbor as he took his departure for a distant port. This event is in the memory of some men who have lived to know that in the year 1888 there left New York Harbor for transatlantic ports 1,320 steamships, carrying 147,329 passengers and over 3,500,000 tons of freight, while there arrived at the same port 480,451 passengers and over 3,000,000 tons of freight.

At 11 o'clock on the following morning, the master records the fact that they "got the steam up and it came on to blow fresh; we took the wheels in on deck in 30 minutes." This peculiar performance of taking in the wheels during a storm, through fear of having them washed away, or damaged, was unique. In the published records of steam navigation no allusion is made to any other vessel with the wheels similarly constructed, either before or since the *Savannah* went to sea. The arrangement was, without doubt, made by the direction of Moses Rogers, who in 1808, while taking the *Phœnix* from Sandy Hook to Cape May (en route from New York to Philadelphia), was compelled to run that steamboat through Barnegat Inlet into the bay and up on the beach, in order that the wheels, which had been damaged by a storm, could be repaired.

By examining the log book of the *Savannah* it will be noticed steam was seldom used except in calm weather, or when it was desired to show the power of the engine of the vessel.

On the 3d of April, the weather being calm and pleasant, the log states at 3 p. m., "*stowed* the wheels and started the wheels, *firld* all sail."

But the run under steam was of short duration, as the fore and aft sails were unfurled at 5 o'clock the next morning, and the crew at "8 a. m. folded up the wheels and stowed the wheels." During the whole voyage, from New York to Savannah, we find that the engine was running:

| | Hours. |
|---|---|
| March 29 | ½ |
| From April 2, 3 p. m., to April 3, 8 a. m | 17 |
| From April 3, 6 p. m., to April 4, 8 a. m | 14 |
| From April 5, 10 p. m., to April 6, 4 a. m | 10 |
| | 41½ |

The vessel came to anchor at 4 a. m. April 6, eight days fifteen hours (207 hours), from Sandy Hook Light.

The Savannah "Georgian" of Wednesday, April 7, 1819, states:

> The elegant steamship *Savannah* arrived here about 5 o'clock yesterday evening. The bank of the river was lined by a large concourse of citizens, who saluted her

with shouts during her progress before the city. She was also saluted by a discharge from the revenue-cutter *Dallas*. Her appearance inspires instant confidence in her security. It is evident that her wheels can be unshipped in a few minutes, so as to place her precisely in the condition of any other vessel in case of a storm and rough sea. Our city will be indebted to the enterprise of her owners for the honor of first crossing the Atlantic Ocean in a vessel propelled by steam.

### II.—IN THE HARBOR OF SAVANNAH AND A ROUND TRIP TO CHARLESTON.

After the vessel was tied to the wharf at Savannah, April 6, nothing important seems to have transpired on board, "all hands being employed in ship's duty," until Wednesday, the 14th, when the wheels were put on, and "at 10 a. m. got the steam up and started from Savannah for Charleston; at 1 p. m., blowing fresh, come to anchor off Tybee Light." There the vessel remained until 7 o'clock next morning, when she weighed anchor, "got steam on," and came to anchor at 8 p. m. four leagues from Charleston Light, and "let the steam off." At 6 o'clock next morning, after the pilot came aboard, they "got steam on," and "at 11 a. m. hold to the wharf at Charleston and made fast." This trip was made with the hope that the President of the United States, who was visiting Charleston, might be persuaded to proceed to Savannah with the ship on the return trip. Here the vessel remained until the 30th, when, at 10 a. m., she got under way, with steam, arriving at the wharf at Savannah, 1 o'clock the next afternoon, twenty-seven hours out.

With the exception of "taking in cole" on May 7 and 8, nothing important seems to have occurred while in port until Tuesday, the 11th, when "President of the United States, James Munroe and suit, came on board of the ship at 8 a. m. to go to Tybee light-house; at 8 a. m. got the steam up and started with the steam; at half past 10 a. m. anchored at Tybee; at 11 a. m. got under way with steam for town again at 8 a. m., held to the wharf and made fast."

This must have been a gala day for Captain Rogers and his crew, since the pleasure of the occasion was heightened by propitious weather, the faithful chronicler recording in the log book that the day began with "light breezes at N. W. and clear." President Monroe was at that time making a tour of the Atlantic States, inspecting arsenals, fortifications, and public works. A writer describing this tour states: "In every point of view the journey was auspicious. Party lines seemed about to disappear and the country to return to its long past state of union. The President was not backward in his assurance of strong desire on his part that such should be the case."

That his wishes were gratified* in this respect may be inferred from the fact that in 1820 his reëlection was practically unanimous, as he received 231 out of the 232 electoral votes cast. His famous message of December 2, 1823, in which he advocated the policy of not interfering with the powers of the Old World, nor permitting the Old World to interfere with the New, was the foundation of what has gone into history as the "Monroe Doctrine." To a statesman of such broad views, the establishment of a Transatlantic steamship line between Savannah and Liverpool, by an American company, was indeed an important matter, and the success of the trial trip to Tybee Light and return must to him have been gratifying in the extreme.

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* In 1819 Spain ceded East and West Florida and the adjacent islands to the United States.

The President was greatly pleased with the machinery of the *Savannah*, and expressed the desire that when the vessel returned from foreign ports she be brought to Washington for the inspection of Government officials and Congressmen, with a view to her purchase for coasting service off the coast of Florida, where Cuban pirates were giving great annoyance to American shipping.

The President seems to have had a namesake on board, for the next day while the crew was taking in wood, the "log" tells us that "Daniel Claypit cut his left thumb off, the doctor done it up, and then bled James Monroe;" as the sailing master spelled the President's name Munroe, it was probably not a relative of his excellency who was bled.

On Saturday, May 15, we find that "a heavy thunder squall rose from the N.W. and broke the *Savannah* and two other ships adrift: Broke the paddles adrift and beat the arms."

After cutting one man's thumb off; bleeding another, and bending the ship's arms, by a storm, it was to be hoped that no further record of accidents would be found in the "log" while in port. But, alas, such was not the case. On Thursday, May 20, we find, "about 2 a. m., John Weston, coming on board from the shore, fell off the plank and was drowned; at 10 a. m. caught John Weston with a boat hook and jury was held over him; braught in axcerdental deth; took him on board and put him in a coffin."

Thus the first seaman of a Transatlantic steamer that was drowned lost his life by falling from a plank while the vessel was in port.

This accident caused a delay in the date of sailing, for the "Georgian" of Wednesday, May 19, 1819, states: "We are requested to state that the steamship *Savannah*, Captain Rogers, will, without fail, proceed direct to Liverpool to-morrow, 20th inst. Passengers, if any offer, can be well accommodated." Notwithstanding this notice the vessel remained in port during unlucky Friday, "all hands employed in ship's duty."

### III.—VOYAGE FROM SAVANNAH TO LIVERPOOL.

Under date Saturday, May 22, 1819, Sailing Master Rogers writes, at "7 a. m. got steam up, winded ship, and hove up the anchor, and at 9 a. m. started with the steam from Savannah." Feeling satisfied with what the ship had accomplished during a nine days' voyage along the shore, Capt. Moses Rogers was willing to risk his own fortunes and the interests of his employers in making the crucial test of the vessel's ability to cross the ocean. And after remaining at Tybee light for several hours, the log book states: "At 5 a. m. (Monday, May 24), got under way of Tybee light, and put to sea with steam and sails. At 6 a. m. left the pilot. At 8 *a.m. took off the wheels in 20 minutes.*"

Captain Rogers's care of the wheels may be explained from his desire that the vessel should reach Liverpool without damage to them or the machinery, which had been constructed under his supervision.

The following is an extract from the "Georgian," Thursday, June 24, 1819:

> Captain Livingston, of the schooner *Contract*, who arrived at Newburyport on the 5th instant, sighted on the 29th of May, latitude 27.30, longitude 70, a vessel ahead to eastward, from which he saw volumes of smoke issuing. Judging it to be a vessel on fire, stood for her in order to afford relief; "but" (observes Captain Livingston) "found she went faster with fire and smoke than we possibly could with all sail set." It was then discovered that what we supposed a vessel on fire was nothing less than a steamboat crossing the western ocean, laying her course, as we judge, for Europe; a proud monument of Yankee skill and enterprise. Success to her.

The log book of the *Pluto* contains the following passage:

> JUNE 2, 1819. Clear weather, smooth sea, latitude 42 degrees, longitude 50 degrees.* Spoke and passed the elegant steamship 8 days out from Savannah to Petersburg, by way of Liverpool. She passed us at the rate of 9 or 10 knots, and the captain informed us she worked remarkably well, and the greatest compliment we could bestow was to give her three cheers, as the happiest effort of mechanical genius that ever appeared on the western ocean.

June 17th, at noon, the *Savannah* was overhauled and boarded off the coast of Ireland by the king's cutter, *Kite*, whose crew, seeing the smoke rising from the stack of the *Savannah*, thought the vessel was afire. The London "Times" of June 30, 1819, alluding to this event, says:

> The *Savannah*, a steam vessel recently arrived at Liverpool from America—the first vessel of the kind which ever crossed the Atlantic—was chased the whole day off the coast of Ireland by the *Kite*, revenue cruiser, on the Cork station, which mistook her for a ship on fire.

Under date June 18 we find the melancholy announcement, at "1 p. m. Cork bore west b. S. 5 leagues distant." At "2 a. m. calm; no cole to git up steam." This must have been a great disappointment to Captain Rogers, who doubtless wished to run up the English Channel under steam. Under the circumstances, however, we find that "with all sails set to the best advantage," at 2 p. m. (Sunday, June 20, 1819) the *Savannah* "hove too off the bar for the tide to rise." At "5 p. m. shiped the wheels, firld the sails, and running to the river Mercer at 6 p. m., came to anchor off Liverpool with the small bower anchor;" twenty-nine days eleven hours from Savannah, during which time the vessel had run under steam eighty hours.

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*About 60 miles due south from the southern point of the Grand Bank of Newfoundland.

The following table shows the number of hours the engines were at work during the voyage from Savannah to Liverpool.

| Got steam up. | Shut steam off. | Hours. |
|---|---|---|
| May 30, 8 a. m......... | May 30, 6 p. m ........ | 10 |
| June 1, 8 a. m...... .. | June 2, 2 a. m ......... | 18 |
| June 6, 8 a. m ......... | June 6, 12 p. m ........ | 16 |
| June 9, 8 a. m ......... | June 9, 12 m .......... | 4 |
| June 11, 10 a. m ....... | June 11, 12 p. m....... | 14 |
| June 16, 8 p. m ........ | June 17, 2 p. m ....... | 18 |
|  |  | 80 |

Marwade's "English Commercial Report," June 22, 1819, thus records the arrival of the *Savannah* at Liverpool:

> Among the arrivals yesterday at this port we were particularly gratified and astonished by the novel sight of a fine steamship which came around at 7:30 p. m. without the assistance of a single sheet, in a style which displayed the power and advantage of the application of steam to vessels of the largest size, being 350 tons burden. She is called the *Savannah*, Captain Rogers, and sailed from Savannah (Georgia, United States), the 26th of May and arrived in the channel five days since. During her passage she worked the engine 18 days. Her model is beautiful and the accommodations for passengers elegant and complete. She is the first ship on this construction that has undertaken a voyage across the Atlantic.

The following is a communication from the American minister at London to Hon. John Quincy Adams, the Secretary of State:

> [Official dispatch No. 76. From the U. S. Minister Richard Rush to the Department of State.]
>
> LONDON, *July* 3, 1819.
>
> SIR: On the 20th of last month arrived at Liverpool from the United States the steamer *Savannah*, Captain Rogers, being the first vessel of this description that has ever crossed the seas, and having excited equal admiration and astonishment as she entered the port under the power of her steam.
>
> She is a fine ship, of 320 tons burden, and exhibits in her construction no less than she has done in her navigation across the Atlantic, a signal triumph of American enterprise and skill upon the ocean.

Lloyd's List reports the arrival of the *Savannah* at Liverpool on the 20th of June, 1819, bound to St. Petersburg; and in "Gore's Annals of Liverpool" this American steamer's arrival is recorded among "remarkable events."

Nile's New York Register, August 21, contains this paragraph:

> The steamship *Savannah*, Capt. Moses Rogers, the first that ever crossed the Atlantic, arrived at Liverpool in 25 days from Savannah, all well, to the great astonishment of the people at that place. She worked her engine 18 days.

A correspondent of the Charlotte City "Gazette" writes from Norfolk, August 10, 1819:

> I have received no shipping list by this arrival, but an article of great importance in the steam world (if I may use the expression) is contained in the Cork paper of the 19th of June. It is no less than the arrival at Kinsale, in 21 days, of the steam-

ship *Savannah*, from Savannah, laden with cotton and passengers. She put in for supplies, would remain for a day or two, and then proceed for Liverpool. Previous to her putting in she was chased by a cutter under the impression that she was a ship on fire. No further particulars are stated.

### IV.—IN THE PORT OF LIVERPOOL.

During the twenty-five days that the *Savannah* remained in the port of Liverpool, she was visited by officers of the navy and army and many persons of rank and influence. The crew was engaged in scraping and painting the vessel; "all hands employed in sundry jobs of ship's duty" being the usual daily entry in the log book. On the 16th of July a supply of coal was put aboard, and on Sunday, the 18th, the engineer "got steam up and started the wheels." On Monday, the 19th, Captain Rogers appears to have had some difficulty in getting his crew on board the ship, having to send an officer ashore after "James Bruce and John Smith to get them on board; they would not come; the watchman put them in the boat; John Smith tried to knock Mr. Blackman overboard," and was finally put in irons. On July 21 the *Savannah* weighed anchor and dropped down the Mersey, bound for St. Petersburg.

### V.—LIVERPOOL TO ST. PETERSBURG.

On the 23d of July the vessel got under way with a full head of steam; she appears to have had a pleasant passage, arriving at Elsinore on the 9th of August. Here she remained in quarantine until August 14, when she sailed for Stockholm, reaching that city on the 22d. On the 28th, six days after her arrival, it is recorded in the log that at noon "His Royal Highness Prince of Sweden and Norway visited the ship." On the 1st of September an excursion in the adjacent waters was arranged by Captain Rogers and Mr. Hughes, the American minister, whose wife and many foreign ministers to the Swedish court, nobles, and prominent citizens were included in the party.

Seaman John Smith does not seem to have profited by his experience, in spending the last two days in irons that the ship was in Liverpool harbor, for we find that on the 3d of September while at Stockholm "John Smith and Henry Wauripe took the ship's boat and went ashore without liberty and got drunk." What punishment was meted to them for this offense is not stated.

On the 5th of September the *Savannah* left Stockholm, arriving at Cronstadt on the 9th and at St. Petersburg on the 13th. On three days, September 18, 21, and 22, the *Savannah* was maneuvered under steam in the harbor of St. Petersburg, having on board many of the royal family, Russian nobles, officers, and foreign ministers.

From Liverpool to St. Petersburg steam was used more continuously than on any former voyage, as will be seen in the table below.

*Hours under steam from Liverpool to St. Petersburg.*

| Got steam up. | Shut steam off. | Hours. |
|---|---|---|
| July 23, 1 p. m | 12 p. m | 11 |
| July 26, 8 a. m | July 28, 12 m | 52 |
| July 31, 11 a. m | Aug. 1, 9 a. m | 22 |
| Aug. 8, 12 m | Aug. 9, 12 p. m | 36 |
| Aug. 15, 12 m | Aug. 15, 9 p. m | 9 |
| Aug. 18, 12 m | Aug. 20, 4 p. m | 52 |
| Aug. 21, 12 m | Aug. 22, 8 p. m | 32 |
| Sept. 5, 10 a. m | Sept. 5, 8 p. m | 10 |
| Sept. 8, 12 m | Sept. 8, 12 p. m | 12 |
| Sept. 9, 7 a. m | Sept. 9, 9 a. m | 2 |
| Sept. 15, 10 a. m | Sept. 15, 11 a. m | 1 |
| | | 239 |

About ted days out of thirty-three.

While the ship lay at Stockholm and St. Petersburg, Captain Rogers was in negotiation, on several occasions, for the sale of the vessel to the Swedish and Russian governments, but as the terms offered were not satisfactory to him, he concluded to bring the *Savannah* back to America.

On the 27th and 28th of September the log book records "all hands employed taking in coal" for the homeward journey.

The ship sailed on the 29th for Cronstadt harbor, where, after experiencing rough weather, during which she lost a hawser and an anchor, she finally, on the 10th of October, " at 9 a. m. got under way with steam past the gard ship laying off Cronstadt, then took in the wheels and set sail (for Savannah) in company with about eighty sail of shipping."

### VI.—Voyage from St. Petersburg to Savannah.

The voyage from St. Petersburg to Savannah seems to have been unmarked by any incident of importance. October 17 the vessel touched at Copenhagen and the "captain went on shore and cleared the ship." On the 22d the record shows that the vessel "took a pilot on board, who took the ship into anchor in the harbor of Arendale on the coast of Norway."

The homeward passage was a stormy one; heavy winds, rough sea, gales and storms being almost daily noted in the log.

The engines were not used during any part of the return trip until the 30th of November (the fortieth day after leaving Arendale, Norway), when Captain Rogers "took on a pilot inside the bar," and "At 10 a. m. anchored in the Savannah River and firld sails on the flude tide, got under way with steam and went up and anchored off the town."

Thus the *Savannah* safely and triumphantly returned to her home port, six months and eight days from the date she had sailed upon the first transatlantic steamship voyage; and thus by American mercant enterprise, mechanical ingenuity, and courageous seamanship, the first step was successfully completed in the undertaking which marked an important epoch in the world's progress, opened the way for more inti mate relations between distant countries, and inaugurated the revo tion in methods of ocean transportation which followed within t decades.

The ship remained at Savannah until the 3d of December, when sh sailed for Washington. At 8 p. m. on the 14th of December she arrived at the mouth of the Potomac River. The 15th and 16th were consu in coming up the river under steam and "at 6 p. m. hald to the wh at Washington and made fast," the voyage closing with a per mance of Frank Smith (possibly a relation of John's), who, the l states, "damd and swore at the captain and struck him two or thr times, and then Smith was put in irons."

### LOSS OF THE SAVANNAH.

The remainder of the history of the *Savannah* can be briefly told.

The great fire in Savannah in January, 1820, brought pecuniary e barrassment upon her owners, who, failing in their efforts to sell t vessel to the Government, were compelled to dispose of her elsewh Her engines were removed and sold to the Allaire Iron Works, of N York City, for $1,600, and put to other uses.

In the great Crystal Palace exhibition of 1856, the 40-inch cyli was exhibited as an historical relic in connection with the log book.

After the vessel was divested of her engines, she ran between N York and Savannah, as a sailing packet, for several years, under c mand of Capt. Nathan Holdredge. She ran ashore on Long Island went to pieces in 1822, a few months after the death of her comman

Thus the first experiment (for it may be called an experiment, as *Savannah* never carried a single passenger or pound of freight for while she was a steamship) in transatlantic steam navigation ended many other experiments before and since, in financial disaster to original projectors. This failure postponed, but fortunately did not vent, the final success of the project.

In justice the names of those who furnished the means for this perimeent, and who suffered financial loss because its success did lead to the immediate fulfillment of their hopes, should not be forgo

Thirty-seven years afterward (1856) the files of Congress show Mrs. Taylor, then almost three score and ten years old, filed a pet in which she states:

> Your petitioner is the only surviving child of the late William Scarborough, vannah, Georgia, who, being an energetic and enterprising man of great mer genius, caused to be constructed in the years 1818–'19, with his own means and of every friend he could enlist in the effort, the first steamer that ever cros Atlantic, the *Savannah*, of Savannah, Georgia, Capt. Moses Rogers, of New L Connecticut, commanding.

For details of this voyage she refers to the sworn statement of Capt. Stevens Rogers, the sailing-master, "and prays that they will grant her some pecuniary acknowledgment, etc."

At New London, Connecticut, May 2, 1856, Capt. Stevens Rogers swore that he is aged 68 years; that he was the sailing-master of the steamship *Savannah* on her trial trip to Liverpool. Copenhagen, St. Petersburg, etc., and that:

> Said steamship was built in New York in the year 1818, the builders being Fickett & Crocker. She was designed for a Havre packet, and was purchased by William Scarborough, of Savannah, and was named at his suggestion *The Savannah*, he having told me that in his opinion the ocean would be navigated by steam, and he intended his own State and city should have the credit of sending the first steamer across the Atlantic. Her castings were made in New York, and her boilers at Elizabethtown, New Jersey, by Daniel Dodge. She left New York under canvas, and arrived at Savannah in the early part of May, 1819. President Monroe was then in Charleston, South Carolina, and Mr. Scarborough directed us to go there and give the President an invitation to come to Savannah on the steamship. The President declined, because the people of Charleston did not want him to leave their State in a Georgia conveyance, but said that he would visit us at Savannah. So we returned. A few days after we got back the President arrived, and came on board the vessel with his suite and several naval officers and citizens. The vessel was navigated by steam, and we proceeded down the river on an excursion. The President dined on board, and expressed himself greatly pleased with the vessel, and told Mr. Scarborough that when she came back from her trip across the Atlantic to bring the vessel around to Washington, for he thought there was no doubt the Government would purchase her, and employ her as a cruiser upon the coast of Cuba.
>
> We sailed from Savanah for Liverpool on the 26th of May, 1819. Moses Rogers, my brother-in-law, was master and engineer. I was sailing master and Mr. Blackman was third officer. We made the port of Liverpool in 22 days after leaving Savannah, 14 of the 22 under steam. The only reason why the whole voyage was not performed by steam was the fear of the fuel giving out. Off Cape Clear the admiral at Cork dispatched a ship to our relief, supposing we were on fire. At Liverpool we caused a great deal of excitement, and suspicion of having some design to release Napoleon from St. Helena. From Liverpool we proceed to Copenhagen, and thence to Stockholm. At both places the *Savannah* excited great curiosity; at the latter place she was visited by the royal family, our minister, Mr. Hughes, and Lord Lynedoch.
>
> Lord L. went with us to St. Petersburgh. On the passage he desired us to bring the vessel from steam to canvas. He held his watch and noted the time—15 minutes. He was so delighted that he exclaimed, "I blame no man born in the United States for being proud of his country; and were I a young man I'd go there myself." The Emperor of Russia came on board at Cronstadt, and was much pleased with the vessel, and presented Captain Rogers with 2 iron chairs (one of which is now in the garden of Mr. Dunning, at Savannah). Stevens Rogers then states that he has in his possession a gold snuff-box presented to him by Lord Lynedoch—to Stevens Rogers, sailing-master of the steamship *Savannah*, at St. Petersburg, October 10, 1819.

The petition of Mrs. Taylor to Congress for aid was not successful. Neither officers nor owners received any recognition of their services, and no attempt has ever been made by the General Government to perpetuate the memories nor to preserve the history of the pioneer voyages of the *Savannah* and her courageous crew.

After the *Savannah's* voyages no attempt was made by a vessel to cross the Atlantic under steam for several years.

Steamboat-owners confined themselves to voyages along the coast and to near ports on adjacent islands.

The matter, however, was frequently broached in the public prints and many projects were mentioned.

### THE SECOND STEAM VESSEL TO CROSS THE ATLANTIC.

In 1827, 8 years after the return of the *Savannah* to America, a com pany composed of merchants from Amsterdam and Rotterdam wa formed to inaugurate steam navigation with the Dutch West Indie The steamship *Curacoa*,* 350 tons, was constructed for the company o the Clyde, and made the initial trip successfully, sailing from Antwer August 12, 1828. This voyage was repeated during the year, but th line was not a commercial success.

### THE THIRD TRANSATLANTIC STEAMSHIP.

The *Royal William*, 360 tons, 160 feet long, 44 feet beam, schooner rigged, was built at Quebec in 1831 and engined at Montreal. The fo lowing year she crossed the Atlantic and arrived safely in Londo There she attracted the attention of the agents of the Spanish Gover ment, who purchased her, changing her name to *Isabella II.*

She was the first Spanish war vessel.

Such was the condition of affairs when, in 1833, Dr. Junius Smit an American who had resided for 30 years in London, entered with en thusiasm upon the scheme of establishing a steamship line betwe England and New York. After much arduous labor the British a American Steam Navigation Company was capitalized at £1,000,0 the subscription books being opened in July, 1836.

The stock was rapidly subscribed, and a few months later a contr was entered into for a steam frigate of 1,700 tons burthen, to have t engines of 225 horse-power each, at a cost of about £60,000.

The firm who was to engine the vessel, however, failed, and a ne contract was entered into with Robert Napier, of Glasgow, which r sulted in the completion of the 2,400 tons steamship *British Quee* the spring of 1839—a twelvemonth later than the first steams ordered was expected to be delivered.

In the meantime the *City of Kingston*, the fourth steamship to cr the Atlantic, had arrived in New York from Cork, Ireland, 2d Ap 1838; and the *Great Western*, a 1,300-ton steamship, with 200 hor power engine, designed by Brunell, the celebrated engineer, had b constructed and launched by the Great Western Railway, of Engla at a cost of about £50,000.

The British and American Line being anxious to be foremost in t field, leased the *Sirius*, a 700-ton ship, and had her hastily overha for a transatlantic trip. The *Sirius* sailed from Cork at 10 o'cloc the morning of April 4, 1838; and the *Great Western* left Bristol, the same port from which the Cabots sailed years before, at 2 o'clock in the afternoon of the 7th of the same month.

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* The same burthen as the *Savannah*.

The story of the first steamship race across the Atlantic half a century ago is a tame affair compared with the weekly trials of speed by the numerous 5,000-ton "Ocean Greyhounds" now running weekly between the two hemispheres; and upon which hundreds of tons of coal are burned to reduce the record by a few minutes. Nevertheless, both continents were electrified by the accounts of the preparations for this trial of speed, and citizens of all classes eagerly watched the results. On the 23d of April, 1838, both vessels arrived at Sandy Hook, the *Sirius* preceding the *Great Western* by a few hours.

Commenting upon this event, the "Atheneum" pays this glowing tribute to the American people:

> The generous and enthusiastic welcome with which the officers of the *Sirius* and *Great Western* were received in New York does honor to the Americans; every possible testimony of respect and hearty good will and good wishes were shown to them; not a whisper of regret was heard at the time that the great enterprise had been attempted by British skill; they were welcomed as brothers by men who saw only in this event the revolution which had been at once effected in the commercial, and we may say in the social, relations of the two countries, an event which will form an epoch in the history of civilization itself, which tends to unite in the bonds of enduring fellowship the greatest nations of the earth allied by language common, by literature, by interest, and by blood, and offers to both a guarantee a thousand times more binding than all the treaties that were ever penned for the preservation of that honorable peace which now gladdens and enriches them.*

Under these happy auspices and within twenty years of the pioneer voyages of the steamship *Savannah*, the era of transatlantic steam navigation was fully inaugurated.

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* The Atheneum, May 26, 1838.

# ANTHROPOLOGY AT THE PARIS EXPOSITION IN 1889.

By Thomas Wilson.

At the Exposition of 1867 in Paris there was little or no attempt to represent the science of anthropology. At the Exposition of 1878, however, an effort was made. M. Gabriel de Mortillet was director and the preparation of the display was given into his charge. A modest building was erected in the garden of the Trocadero Palace which was called the building of anthropology. The minister of commerce and griculture took up the matter and lent his aid and confidence, and a reditable display was made. It was small, but quite complete and nade a fair presentation of prehistoric anthropology. The societies nd amateur collectors throughout France responded nobly to his apeal. I remember the elegant display made by Mr. Seidler, of the city f Nantes, who transferred his entire Scandinavian collection to Paris or use in this exposition.

But it was reserved for the Exposition Universelle of 1889 to make ne grand display in regard to anthropology and its kindred sciences. hree exhibits were made. They were not the same, and one tended rgely to supplement the other, making them, when taken in connecon, a most elaborate, wonderful, and complete display.

The most extensive of the three was that under the direction of the inister of agriculture and commerce, and which formed section 1 of e l'Histoire Retrospectif du Travail. This had Drs. Topinard, Hamy, d M. Cartailhac for its directors and managers. The adjoining disay was under the supervision of the minister of public instruction, d it had for its director the Société d'Anthropologie of Paris. The ird was section 5 of the exposition Retrospective du Travail, consisting ely of prehistoric weapons, and was associated with the exhibit of ns in the building of the department of war on the Champ de Mars.

The French people or Government in all former expositions had made rincipal feature of the display called The History of Retrospective bor (l'Histoire Retrospectif du Travail). The Exposition of 1889 was ; to be an exception. The grand commission superior of organiza had Jules Simon, senateur, a member of the academy, for its presit, and twenty-five members which divided the display into five secs. (1) Anthropology and Ethnography; (2) Liberal Arts; (3) Art and Trade; (4) Transportation, and, (5) Military Art. It was assigned the principal nave of the great building devoted to liberal art, or to that half of it north of the rotunda and towards the Seine.

### SECTION I.—ANTHROPOLOGICAL DISPLAY.

It is only with the first section that I have to deal at present—the anthropologic sciences and ethnography. This was placed in th hands of a committee and again divided into three portions. Dr. Topinard had the principal direction of that portion relating to general anthropology with Dr. Magitot in charge of a subsection of criminal anthropology. M. Cartailhac to archæology and prehistoric anthropology. M. Hamy to ethnography. This division was one of theory and science more than of practice, for the objects themselves were not thus divided, and these gentlemen acted more as a committee than separately.

The following was the classification for the division of anthropolog archæology, and ethnography.

#### I.—ANTHROPOLOGY, UNDER DIRECTION OF DR. TOPINARD.

Pieces and specimens of comparative anatomy and embryogeny relative to man; casts of the brain; skulls and skeletons, and in their defau casts; prehistoric skulls, trepanned skulls, and prehistoric patholog specimens; casts of busts and typic masks of the living; instrumen for physical and physiological observations; instruments of cra ometry and anthropometry; charts showing the division and charac of races; photographs of skulls and of ethnic types; composite p tography.

#### II.—PREHISTORIC ARCHÆOLOGY, UNDER DIRECTION OF M. EMILE CARTAILHAC TOULOUSE.

Material for work and specimens representing the different phase the fabrication of primitive instruments; chipping, polishing, perfora tion, etc., of objects of stone; work on bone and on the horn of ru nants; pieces which bear relation to the practice of art, of design drawing, etc.; primitive pottery; views and plans or models of h itations, funeral monuments, antiques, etc.; casting or hammerin metal, bronze, copper, iron; specimens of molds and objects of me cast or hammered; caches of the fondeur; origin of glass, ena etc.; terms of comparison borrowed from savage populations— making, fabrication of objects of stone, of wood, of bone, of potter comparative metallurgy.

#### III.—ETHNOGRAPHY AND CLASSIC ARCHÆOLOGY, UNDER DIRECTION OF DR. H

Dr. Hamy was assisted by several oriental travelers and scho MM. Maspero, Villefosse, Perrot, Solomon Reinach, and others. divisions were as follows;

Objects relative to the history of work in antiquity: Egypt, Assyria, Phenicia, Greece, the Roman Empire, and particularly Gaul, the extreme Orient, and the New World; models, plans, etc., and characteristic constructions; sculptures and paintings (originals and copies), reproducing the manual art; scientific apparatus and material for industrial art to the reign of Charlemagne; specimens representing the different phases of fabrication and collections of characteristic products.

### I. GENERAL ANTHROPOLOGY.

The display of anthropology in general, was marvelous. A résumé of it shows that there were 115 busts or entire figures of races; 77 pieces or casts of brains; 15 of the hand; 234 human skulls or their casts, of which 48 were prehistoric or very ancient; a considerable number of paintings, charts, etc., these being all furnished by 71 persons, of which 24 came from foreign countries, among which are named Great Britain, the United States of America, Brazil, Germany, Austria, Norway, Denmark, Belgium, Switzerland, and Italy.

On entering the building of Liberal Arts from the side facing the Seine the first object which struck the eye in the section of the Histoire Retrospectif du Travail was a gigantic gilt statue of the Japanese Buddha—one of the grandest and largest known. It came from the city of Nara, which was in the eighth century the capital of Japan, and one of the great centers of the Buddhist religion.

"Derrière le Grand Buddha" was the place of rendezvous for all anthropologists during the Exposition. This was the entrance to the pavilion of anthropological science. To the right of the Grand Buddha were the three skeletons, in their original soil, found by Dr. Rivière in the Grotte of Mentone, near Nice, with whom I had formed an interesting acquaintance during my residence as consul at that point. The earth was cut around the sides and at the bottom so as to lift them without disturbance and then placed on blocks, and thus transported to Paris and are now here displayed. The larger and most important of these skeletons is that at the Jardin des Plantes, Paris. None of these have ever been disturbed or taken out of their native soil as found in the caves.

To the left were casts of the two Bushmen, who had been presented to the Société d'Anthropologie in October of 1886, in my presence. One of the men was afterwards cast in full life. He died one month after the casts were taken.

On the outside of the pavilion, to the right and left, respectively, of the Grand Buddha, were the two cases containing the objects from the United States transported to Paris by me. When the various congresses were in session during the Exposition and the members visited the anthropological section of the Exposition each exponent was expected to be at his respective place to show his objects, to make such explanations as might be needed, and answer such questions as might be put. I spent the principal or a large part of the time during the weeks of the meeting of the Congress of Prehistoric Anthropology engaged in this and similar duties.

Entering the pavilion we come at once to the subject of anthropology and the anthropological sciences. Dr. Topinard attended on every other day, at 10 o'clock in the morning, to give instructions and answer questions. The public were invited to be present at the conferences, and they were attractive and interesting as well as instructive.

In the entrance to this pavilion was the exhibit of Mr. Carl Lumholtz, the Norwegian traveler and anthropological investigator in Australia and among the Australians. His display consisted of Indian relics from the mounds of Ohio and Minnesota.

Possibly no better understanding could be given of the science of anthropology, as it is taught in France, than by a description of the charts and tables displayed by Dr. Topinard and used by him before the École d'Anthropologie. The following were displayed:

(1) Place of anthropology in science.

(2) Place of man in the classification of mammals.

(3) Genealogical tree of the animals up to man, according to Lamarck.

(4) The distance of man from the anthropöides as determined by the weight of the brain and capacity of the skull.

(5) Composite sterographic representation of different races.

(6) An example of the variation of character in a single human group, taken from measurements of the cephalic index of 1,000 Parisians.

(7) The average weight of brain of man in his ordinary condition but at different periods of his life.

(8) The same, divided the same way, of men in peculiarly good condition, as of professional men, those of leisure, etc. The excess over the former is 10 per cent.

(9) The same of woman. The difference against woman when compared with the ordinary man is 4 per cent.

(10) The curved lines representing the average variation of the weight of the brain in man from 15 years of age until his death. Average taken from 1,551 cases.

(11) Classification of the cephalic index by units and also by 5 units, according to the quinary nomenclature.

A series of anthropologic charts, sixteen in number, forming a single work, relative to the color of eyes and hair of persons in France, and giving full statistics.

There were the same kind of charts prepared by other persons. Drs. Collineau, Bertholon, and Lelarge, gave the division and classification for France, Tunis, and Corsica, showing the index cephalic, the nasal index, the height according to departments and given localities. All these showed the extremes as well as the average of each characteristic.

There was a chart of the same kind, showing the divisions of the Berber race in Tunis.

There were similar charts and statistics relating to Germany, by Dr. Schaaffhausen, of the University of Bonn; of A. B. Meyer, of Dresden. Prof. Virchow presented his great chart on the color of the eyes, hair, and skin of 2,000,000 of school children in Germany, taken during the year 1875, showing the percentage of blonds, of brunettes, of brown eyes to blue eyes, of brown hair to blond hair, and of gray eyes to light eyes.

There were also anthropologic charts from the British Islands, showing practically the same classifications, prepared by Dr. John Beddoe, of Bristol, England.

The same for Norway, by C. Arbo; of Switzerland, by Dr. Kollman.

Also ethnographic charts of Caucasus, by Monsieur Emil Chantre; of south oriental Europe and of Dobrusha, by M. A. Rosny; of Asia, by M. Deniker, librarian at the Museum of Natural History, Paris, together with his proposed classifications of the human race based on their affinities and anthropologic characters. He groups the people of Asia into twenty-six grand divisions, and these again, according to locality, into two hundred peoples or tribes.

The two systems of representation were shown, that of Drs. Topinard and Beddoe, and the other that of Professor Virchow. The first was represented by the charts of Beddoe, Bertillon, Collineau, Arno, Arbo, and the other by the charts of Virchow and Kollman. In the first, adults only were reported; in the second, children.

The prehistoric skulls or their casts on exhibition numbered forty-eight. Among these were all the principal ones, or their duplicates, Neanderthal, Olmo, Canstadt, Brux, Mentone, Solutrê, Cro-Magnon, Laugerie Basse, Spy, etc.

Those from Spy were taken from their pedestals and exhibited by their discoverers before the congress of anthropology, and the necessary descriptions were given.

Monsieur Tramont exhibited a series of comparative anatomy of vertebrate animals, consisting of thirteen skeletons. They were arranged to show the relationship between man and these animals, and, beginning with the higher and going downward, they were, a man, a chimpanzee, an ourang, a monkey of the ancient continent, one of the new continent, a limure, a bat, a lion, a kangaroo, a reptile, and two fish. Along with it was another series of five pieces showing the evolution of the brain from the fish to the man. The same of the foot and hand, showing the series from man down—five pieces. Another of the brain represented by twenty-six pieces, ten of which showed the structure of the brain, two its exterior part, and eleven its convolutions. Dr. Capitan presented an exceedingly interesting series relating to prehistoric trepanation. There were a number of prehistoric skulls bearing evidences of trepanation; one, a human, bore upon its right side a deep circular groove, from which the circular piece was intended to be taken out; another, a modern human skull, in which the processes of prehistoric trepanation in its various stages were shown; the cut was made deep, then slighter, a portion of the rondelle taken out, and finally, the entire piece. This operation was performed by Dr. Capitan to show how it might have been done in prehistoric times. The implements with which it was performed were all laid by the side of the skull. They were the knives and scrapers of sharp flint, pieces of wood and bone to support them, and by which the trepanned piece could be lifted out.

There were also skulls of dogs, one of which had been trepanned after death, another which had been trepanned during life, and lived three weeks. Again another which had the same operation performed and lived six months; another, six weeks. These dogs had all been cured of the operation and were in a situation to live as long as they might. They were then killed for the purpose of obtaining the information concerning the operation. The results were such as to show that the implements and instruments used produced a trepanation identical with those observed upon prehistoric skulls.

This display of Dr. Capitan would have warmed the hearts of our doctors at the Army Medical Museum if they could but have seen it.

It was supplemented and made much more interesting by nearly all the genuine and original trepanned skulls from France.

It goes without saying that this exposition was filled with all the necessary descriptive charts and casts, colored plates, characteristic subjects for study of anatomy and the human form, but they can not be mentioned here. There were extensive representations of the races and peoples of the islands of the Pacific and Indian Oceans.

Complete series of instruments of craniometry and anthropometry were exhibited; those by Mathieu, Collen, Tramont, Molteni, Colas, and Mr. Francis Galton, of Great Britain; also those by Dr. Gillet de Grandmont by Hamy of the Ethnographic Musée of the Trocadero, Demeny of the College de France, Dr. Luigi Anfosso, and others from Italy, and not to be forgotten was that of Dr. Benedikt of the University of Vienna. He has just published a work upon the subject of craniometry.

It has appeared to me fit in times past to criticise adversely the apathy, if not to say opposition, on the part of some of the people of the United States to the science of anthropometry. Anthropometry and craniology may not have been able to classify the races of men in either a perfect or approved manner, and so some of our anthropologists have been led to oppose it; but it is of such benefit and importance as that it ought not to be overlooked nor fall into disuse. I may be excused if I give a list of some of the instruments used for this purpose. I take the exhibit of Mr. Francis Galton. He has described his system and his instruments in the Journal of the Anthropological Institute, and I shall not repeat it.

I. Spirometre to measure the capacity of respiration.

II. Dynamometre for the hand.

III. Dynamometre for the arm.

IV. A series of colored wools to be used in testing the candidates in color-blindness.

V. A rule to determine the individual aptitude to measure and divide distances, to divide angles. Another to test the aptitude or capacity for judging of weight.

IX, X and XI. To test the capacity of the ear to detect differences in sound.

XII. An apparatus to measure an interval, and the difference in its detection between the eyes and the ear.

There was to be added to this list other instruments which were not present because of their weight and their not being necessary. The scales, the measure of height, the measure of the length of arm, the compass, and the models for establishing the colors of the eyes and hair.

With these instruments Mr. Galton established a laboratory of anthropometry at the health exposition of 1884 at London, and he used a formula of tables on which all these things were entered, and one copy kept and another given to the subject. I have one which I received from his laboratory on being measured myself, personally, at the British Association at Newcastle.

The display of M. Mathieu, a mathematical instrument maker on the Boulevard St. Germain, near to the École de Medicine, are those made after the system of Broca. The compass for measuring thicknesses having small balls upon the end, and the graduating arm marking millimetres; a sliding compass marked in the same way; divers goniometres; a craniostat, with its needles for measuring orbits; the endometre; the crochet occipital, and all the tropometre, the apparatus for taking the cubic contents of skulls.

Let no one think that even with all this apparatus he can measure skulls with accuracy or certainty until after he shall have had sufficient practice and instruction. I served in the Laboratoire d'Anthropologie, at Paris, practising upon the same skull for two weeks, the afternoon of each day, before I obtained sufficient degree of manipulation to be able to measure the same skull two times alike.

The apparatus in use in the police department by Alphonse Bertillon was also displayed by their maker, M. Colas. They consisted of (1) scale for measuring the height, standing; (2) scale for measuring the height, sitting; (3) scale for measuring the outstretched arm; (4) the compass of M. Bertillon, (5) the sliding compass to measure the elbow, length of the foot, palm of the hand; (6) small compass to measure the fingers and the ears.

The display of anthropometric instruments made by Dr. Topinard was more interesting as an illustrated history of the science than for actual use. He exhibited various kinds, the earliest ones that were used, their changes, their improvements, etc.; the different methods of measuring skulls—that employed by MM. Ranke, Thann, Holder, Virchow, and, of course, Broca.

Dr. Hamy exhibited a set of anthropometric instruments packed for transportation. They were intended for travelers and to be used in measuring the living person, usually the savage among whom the traveler might pass. They consisted of the various compasses, the measures, etc., together with the tables that were to be used in transcribing them.

The Government of Denmark made a special exhibit at its own expense with its own officers in charge, working, of course, under the direction of the committee.

There was an extensive exhibit from Italy, but it pertained more to anthropology pure and simple, and its relation to crime.

Belgium was well represented, and her museums and societies and amateur collectors lent their objects quite freely and made an elaborate and extensive display, comprising the great discoveries of MM. Fraipont and Lohest in the Grotte de Spy relating to the paleolithic period.

Dr. Cunningham, from the medical college of the Dublin University, made a presentation of twenty pieces prepared by his process of freezing, similar to those now shown in the Army Medical Museum.

Probably the most important, the most unique and valuable contribution in relation to American prehistoric anthropology, was that made by the National Museum of Rio Janeiro, Brazil. It consisted of 9 skulls of prehistoric men, the chief among which was that of Lagoa Santa which was discovered now 15 or more years by Lund during his residence in that country, taken by him to Copenhagen, and lately published by Dr. Soren Hansen. Other prehistoric skulls of the same country and part of the same exposition were those from the shell-heaps of Parama, St. Catharine, etc.

The prehistoric man of Caucasus was represented by the collection of Monsieur Chantre, who has made such studies in that counutry, the results of which have been lately published in his extensive work.

The collection of M. H. H. Risley, director of the ethnographic service of Bengal, comprised about six hundred objects and gave as complete a representation of ethnography in India as was possible.

There were casts of fourteen skulls of Indians from North America. They were all of prisoners in Florida, and the casts were sent by the Smithsonian Institution.

## PREHISTORIC ANTHROPOLOGY.

### FRANCE—PALEOLITHIC PERIOD.

This division was under the special charge of M. Cartailhac. It was arranged by him, and was intended to be as complete an exposition of their own country, France, as it was possible to make. M. Cartailhac classified it as follows:

The first period of the paleolithic age, the alluvium; the second period of the paleolithic age, the caverns; the neolithic period; the age of metal, which he divided into Celtic and Gauloise periods, which brought it to the historic period, and there his display ended. The historical career of France was taken up in another section.

The display of prehistoric archæology was more extensive than one would suppose from the meager description I have been able to give. There were no less than eighty-five cases, tables, shelves, etc. All the epochs mentioned in the description were here displayed. They were divided among the paleolithic, neolithic, and bronze ages, though these were not in all cases kept separate, it being found impracticable to make the classification and divide the collection of each contributor. Making the rudest attempt at classification, I give the following:

### TERTIARY.

[Collections of the Archæologic Society of Vendome. M. Ad. Arcelin, Macon.]

### PALEOLITHIC.

Collections of—
- MM. Cnuisset-Carnot, Dijon.
- M. E. Cartailhac, Toulouse.
- M. Marcellin Boule, Aurillac.
- M. E. Collin, Chelles.
- M. A. Nicaise, Chelles, Marne, Yonne, Aube, Moustier.
- M. Elie Massenat, Correze, Dordogne.
- M. Vauville, Cœuvres, Roche-Bertier, Charente.
- Madame Capitan, Vienne—Surface.
- M. Lejeune, Pas-de-Calais.
- M. Abbe Maillard, l'Erve.
- M. Maurice Feaux, Dordogne.
- M. Michel Hardy, Jean le Blanc, Bruniquel, Badegoule.
- M. Paignon, Montgaudier.
- M. J. St. Venant, Jussy-Champagne, Cher.
- M. Cau-Durban, Haute-Garonne, Grotto de Forges near Bruniquel.
- Viscount de Lastic, Tarn-et-Garonne.
- M. Paysant, Grotte de Reilhac, Rossignol.
- M. Judge Piette, Mas d'Azil, Grotte Duruthy.

Several of these collections of paleolithic implements were from the surface, notably those of M. Cartailhac and Madame Capitan. More than one-half of them contain objects engraved or sculptured. The principal were those of Judge Piette, M. Massenat, Maurice Feaux, Michel Hardy, M. Paignon, M. Cau-Durban, M. Paysant, and Viscount de Lastic.

I can do no better in giving a description of this section of prehistoric archæology than to take a portion of M. Cartailhac's carefully digested and closely written introduction. He says:

The paleolithic period having endured for a long time, presents itself to us with various and successive aspects. The objects of industry, the most ancient of all Europe, are shown in the alluvium of the great rivers, on the shores of which lived our ancestors, having around them a magnificent fauna. Two species of elephants, two rhinoceros, and other animals that appear to have made their rendezvous from Asia and Africa on the territory of France. Secondary, flora to support the life of the various animals, which was made possible by warm and rainy climate. The man of this period is known to us, not by his bones, but only by his industry. We have his implements of chipped stone. The other matter employed in his tools and implements for his weapons were perishable, and thus have not left any record. The stone was chosen with care for that kind of work for which it was to be employed. They are, more than any, the flint, but in certain regions quartz, quartzite, and sandstone. The instruments have been made by chipping, and sometimes the first flakes were used and sometimes the block itself. They were sharpened on their edges and points by retouching, sometimes by shock and sometimes by pressure. It is not possible to distinguish the arms from the tools. The specimens vary much in form, size, and in the finish. Some of them are fashioned with art and delicacy.

This extremely interesting civilization reigned in a great part of the world. Its vestiges are found in eastern Europe, in the north and south of Africa, in India, in the United States. The history of the actual savage resembles it in many degrees.

The second period of the paleolithic age was that of the caverns. The climate became modified, dry and cold. The animals who could not live without heat disappeared. But, on the other hand, we find an abundance of those who remain have retired heretofore towards the colder regions. These are the blue fox, the arctic hare, the reindeer, and on our elevated plateaus the mountain goat, the chamois, and also the siaga or antelope. The plants are recognized as the species which to-day live within the polar circle. The glaciers before and at sundry times have descended or did descend to the plains, and covering to a large extent the valley, now extended amongst the mountains of their actual neighborhood.

It was during this epoch that Europe became separated from the American continent on the one side and with the British islands on the other. The industry is slowly transformed, and it was at first very like that of the period which had just passed. Then new forms appear. The stones, which until then were chipped on both their faces, were replaced by the flakes detached from the nuclei. One face of these flakes remains smooth and untouched, while the other face was retouched with care and thus the implement is brought to an edge and point. These points could have served for spearheads or something similar. Other productions were rather tools, and they are called scrapers or racloirs, such as resemble the instruments of the same kind utilized by savages of the present day, like those of the Eskimo.

Later still the working of this stone took a marvelous development. The tools are easily distinguished from the weapons. These latter are the spears, lances, or arrowheads made of the flake or blades of flint, often large and long, retouched and chiseled with great care on both their faces. The tools, in general of small dimensions were already of great variety. The flakes detached from the nuclei and then retouched became saws, gravers, piercers or perforators, *grattoirs* or scrapers, and the bones of all the animals were utilized in the same way for the same purpose. In the habitation or resting place of the prehistoric people of this epoch thousands of these pieces of flint and of these worked bones are found. The bones, which serve to make the ornaments, pendants, harpoons, arrowheads, needles, and a mass of objects which we can not always recognize the purpose even with all the aids of all peoples who are now in the same level of civilization.

The shells came from the ocean or the Mediterranean. The rock and the silex or flint were brought from distant beds, testimony of their commercial relations of long voyages whether in pursuit or avoidance of savage tribes or in search of better territories for game. Our ancestors frequented and inhabited the caverns or the rock shelters on the borders of rivers which furnished abundance of fish. They do not appear to have known any domestic animals in this epoch. The reindeer and the horse were wild. The ox tribe was represented by the auroch or bison of Europe, and the urus. The domestic dog did not then exist.

No traces of cereals have ever been met with, nor any grinding or pounding instruments, like a mortar or grinding stone, which justifies the belief that agriculture was in progress. Nor was pottery yet in use. This civilization to which they have given the name of the age of the reindeer was the artistic one par excellence of all prehistoric ages. There was an efflorescence of art without precedent. For the first time man drew, engraved, and sculptured living things with which he was surrounded, and brought them out with an æsthetic taste truly astonishing. The hunters of the reindeer had some regard for their dead. They did not yet construct a cemetery, nor did they yet inter the bodies. But they often placed their dead in the grotto and cavern which they occupied, in the ashes of their hearthstone, in the middle of all the débris of their kitchens or industries, nor did they quit their habitations in this grotto for this reason. The dead, in some cases at least, were the objects of particular care. After the disappearance of the flesh the skeleton was covered with red powder, and we find it many times ornamented in what would correspond to different parts of the costume, with marine shells, amulets, the teeth of animals.

The majority of the men of this period belong to the race which have been called Cro-Magnon. There was another with savage aspect, called race of Canstadt or Spy, the name of the localities where the industries have been the best characterized. The stations in France in which these industries have been found number more than one hundred, and there are many others in neighboring countries which show the same civilization and have evidently belonged to the same epoch. There is as yet no natural phenomena which has been taken for a chronometer, or which has been able to furnish dates by which we can determine the antiquity of these two ages of stone.

M. Georges Perrat, member of the Institute of Paris, says that humanity has not even the faintest idea of these two ages. All our studies have not even pierced the darkness. We are lost in the night of our ignorance, and all our studies have not taken us over the threshold of that night.

I will not extend this further. I trust enough has been said to demonstrate the extent and importance of the anthropologic display at this exposition, and to show the importance with which the science is regarded by the savants of France and its adjoining countries. Professor Mason was quite right when he said, as he did in his paper read before the Anthropolical Society ot Washington, and published in the "Anthropologist," that the opportunities to study the natural history of man in Paris during the exposition were unparalleled, and that at any time the French capital affords rare advantages to the anthropologist.

### POLISHED STONE AND BRONZE.

Collections of
- MM. Emile Tate, Aisne.
  - Capitan.
  - Leon Cahingt, Seine Inferior.
  - Judge Piette.
  - Clemment Rubbens.
  - Valentine Smith.
  - Cartailhac.
  - Pitre de Lisle, Brittany.
  - Chauvet, Charente.
  - Dr. Berchon, Madoc.

Dr. Lecocq, Normandy.
Massenat, Lot and Correze.
Lemire.
Eugene Piketty.
Earnest Chantre, Koban, Caucasus.
B. Tornier, Hautes Alpes.
Cau-Durban, Saint-Girons.
Collin, Seine-et Oise.

A magnificent collection was that of Mr. Frederic Moreau, filling nineteen cases and comprising every archæological epoch and period of France. They are principally his own discoveries, and he has published each year for many years a report of his work and a description of the objects found, the latter in the form of an album with beautiful chromo-lithographic illustrations.

### FRANCE—NEOLITHIC PERIOD.

To the cold and dryness of the climate of the epoch of the reindeer succeeded the climate of the present time, though at first more humid than to-day. There was no more rhinoceros, nor elephant, nor the great cave bear, which are now extinct species, nor the reindeer, nor the animals which had been cold-blooded, for they had all emigrated toward the north. The wild animals at the commencement of the neolithic period seem to have been those of the present time, though more numerous than now. Animals became domesticated; the dog was the first, and probably after him the horse. The cultivated plants showed themselves at the same time, though probably in succession and not always the same variety that we now possess. Flax was utilized, but not hemp. The industry indicates to us with what slowness civilization has evolved. Man lived not in the cavern, but only just outside.

The civilization of the neolithic period is characterized principally by the polished stone hatchet. This implement has become so abundant that many communities have counted them by the thousand. Ethnography has taught us that the use of these implements was much varied. Sometimes it was an arm, sometimes a sign of the chief, sometimes a cutting tool, and sometimes an instrument to dig in the eart We have discovered the different systems of the handling of these hatchets and their different destinations. They were made of the local rock and the form varied slightly according to their region. The same observation is true of all contemporaneous objects. This difference in these tools and in the objects of their industry would tend show that there were distinct groups in the population of France at this epoch. It is doubtless true that there are found a number of variations in arms, tools, ornaments, and implements, which on examination as to material, etc., prove to be foreign to the country, and are therefore believed to furnish proof of foreign commercial relations. There were quarries and workshops of flint which seem to have been made for exportation, notably that of Grand Pressigny in the Vienne, Mr.

don, on the Marne, near Paris, also in Aveyron. In all these they had mines of flint, with wells and long and deep galleries for exploring them. Bone, stone, and wood were worked with talent and for various destinations. The pottery became in extensive use.

The Swiss lakes have preserved pieces of textile fabrics from which they can be easily reproduced. This civilization compares with that of the natives of the Polynesian Islands.

The man of that period had the idea to build his habitation above the water, and each lake has preserved at its center and in its bottom the ruins and cumulation of débris which has furnished the most complete information.

The lake dwellings constructed on piles firmly driven into the bottom, were agglomerations of huts or cabins which did not differ very much from those which later were the habitations of the Gaulois. The coast was well inhabited. Each shore bears an enormous accumulation of shells, principally of oysters, in the midst of which we now find well-preserved worked objects, sometimes of flint, sometimes of horn, bone or shell. These shell-heaps are probably the earliest human habitation of the neolithic period.

There has never been found a picture or engraving of a human figure in this stage, except a possibly human representation sculptured in relief on the sides of one of the grottoes in the Marne, and something of the same kind on several dolmens in Normandy and Provence. The neolithic human races were much varied and mixed. No one has been able to determine any relation between any one of them and the monuments which belonged to the same age.

The names given by M. Cartailhac to the periods in the prehistoric history of France subsequent to the neolithic and before the historic period, were the Celtic and Gauloise periods. They correspond with the ages of bronze and iron.

## DESCRIPTION OF SPECIAL EXHIBITS.

Probably the most interesting and instructive collection displayed under the head of prehistoric anthropology and archæology, certainly that which attracted the most attention, was the reconstruction of the families of men of the different prehistoric races. The figures were life size and reproduced after the most accurate study. The greatest care was used in the details of the anatomy, the industry, the costume, and surroundings. They were the combined work of scientists and artists the most capable, and all that the anthropologist, ethnologist, anatomist, and artist sculptor could do was done to make them true and correct representations. One group represented the chellèen epoch or the age of the mammoth, or alluvium, and this was called the first industry. The second represented the cavern period, or the age of the reindeer, and was called the first artist. The third represented the neolithic period, or the age of polished stone. It was the first constructor. The fourth was a bronze foundry and represented the first metallurgist. Each one of these occupied its respective corner in the interior court of prehistoric anthropology.

In the center was a group representing the tent and encampment of the Samoiedes from northern Russia with their outfit of reindeer, etc. This was intended to represent the age of the reindeer of modern times.

Two other groups occupied places in the same court. One represented the age of iron of primitive times and was taken from a group of Soudan blacksmiths; the other was a group of Aztecs making paper of agave plant. The latter was made from models furnished to the Trocadero Museum by the Smithsonian Institution.

These were the work of M. Jules Hebert, the artist modeler of the Trocadero Museum, done under the direction of Dr. Hamy, conservateur of that museum. The principal groups will be described.

### GROUP 1.—PALEOLITHIC PERIOD. CHELLÉEN EPOCH.

(Corresponding to the alluvium or age of mammoth.)

At the foot of a tree which bent over and spread its branches to furnish a protection were a man and a woman engaged in making the rude flint implements of the epoch. (Pl. CLVII.)

The proportions and general forms of the body the cephalic indices and the general morphology of the face are taken from the human crania and bones found in the caverns which have served as habitations for the man of this epoch—Spy, La Naulette, Gourdon—while the flesh and particularly the nose, lips, breasts, etc., are reproduced after atavic types, specially observed in Belgium and the neighborhood of Paris. The costume is imaginary, but was patterned after that of the savages of modern times.

### GROUP 2.—CAVERN PERIOD.

(Corresponding to the age of reindeer or the solutrèen moustierien and madalenien epochs.)

The scene (Pl. CLVIII) represents a woman and a young man engaged in engraving the reindeer horn, as described in the chapter on prehistoric art. The father of the family has just returned from the chase and carries the hind quarters of a mountain goat, which he has killed.

The natural portions of the scene are reproductions of the rock shelter at Laugerie Basse as determined by the discoveries of M. Elie Massanet. The three personages were reconstructed with the aid of the skeletons which had been found almost entire in the caverns of this neighborhood, Laugerie Basse, Cro-Magnon, etc. By their means the anthropologist was able to fix the proportions of the body and the essential forms of the face and skull. The soft parts representing flesh, were made after individuals of an apparently similar race, principally the Berbers, of the type of Cro-Magnon. The arms, tools, and implements were patterned after original pieces obtained from the caverns of the neighborhood. The disposition of the hair of the old man, is that of the celebrated engraving on reindeer horn found at Laugerie Basse by M. Massenat and known under the name of "the man chasing the aurochs." The shells which have been pierced and strung, and worn as ornaments

REPRESENTATION OF THE NEANDERTHAL OR CANSTADT RACE OF MEN.

(The Chellean epoch of the Paleolithic age.)

REPRESENTATION OF THE CRO-MAGNON RACE OF MEN.

(Cavern period of the Paleolithic age.)

around the head and on the arms and limbs, are placed as they were found by M. Cartailhac on the fossil man at Laugerie. The shells and amulets of ivory worn by the woman and the young man are reproductions of those of Cro-Magnon. Thus much is known or, at least, can be fairly judged to be an actual representation of these people. The costumes of skin worn by these people are purely imaginary, for nothing is known concerning them. Therefore, it has been made up from the costumes of various savage tribes. The bones of animals, etc., which lie in such a mass on the ground around the mouth of the cavern are believed to be a substantial representation of the ancient times, and give one an idea of how these things accumulated.

### GROUP 3.—NEOLITHIC PERIOD OR AGE OF POLISHED STONE OR ROBENHAUSEN EPOCH.

The scene depicted in Plate CLIX represents three men erecting a prehistoric funeral monument. One is making a hieroglyph, the second polishing a hatchet by rubbing it on one of the great polishing stones, and the third is making a pottery vase. This epoch or period is quite a different civilization from either of the former. It was characterized by the polishing of stone for weapons, tools and implements, by the development of the ceramic industry, by the invention of architecture, and by sculpture on the face of the rock. This scene is intended to represent the principal of these discoveries. It does not, and, indeed, could not represent the other manifestations of civilization, such as agriculture, sociology, etc. These men are erecting a dolmen. It is not of any particular one, but represents the principal parts of several. The stone with a hole through it, which separates the vestibule from the funeral chambers, is copied from that of la Belle-Haie, near Gisor. The first stone to the left exhibits a feminine figure, or one which has been so considered, though I have had doubts about it. Yet these and similar have been found, one each in Normandy, Marne, and Le Gard. The polishing stone of the second workman is copied from the collection of Dr. Capitan. The vase of the third is made by hand, and one of the common dolmen type.

The remarks heretofore made as to the faithful representation of these personages taken so far as possible from originals, applies here. The potter is a type of one of the races of Furfooz, Belgium, discovered by M. Dupont, and is the oldest potter known. The costumes are reconstituted from similar objects found in the lake dwellings of Robenhausen. This settlement is believed to have been destroyed by fire, and the objects have been charred, and, falling into the lake, the fire was extinguished and they thus preserved. The pieces have been found in such numbers, and extend to such variety, as that the anthropologists feel justified in believing that they have a substantially correct representation. Much of the material is the hammered or bruised bark. Other portions of the costume were of linen cloth, dyed sometimes brown with ochre, sometimes blue with pastel. The foot coverings are inspired by those of an Archaic Gallo-Roman god, *he of the Hammer*, which is believed to have had a high antiquity in that country.

### THE BRONZE AGE.

The scene in Pl. CLX represents a primitive foundry. Under a great rock, protected from the wind by a hedge of dead brush and twigs, a molder and his assistant are engaged in casting implements of bronze. These two personages represent the introduction of bronze which is believed to have come from the Occident. The assistant is of the type of what is called the *Nutons* in Belgium and comes from the *Trou* of that name, being one of the caverns of the Lesse, near the town of Furfooz. This cavern contains a great number of skeletons of men belonging to two distinct types. The Nutons are dwarfs, and this is intended to represent the smaller and inferior of the two races. The master molder is of the type of the most ancient Ligurians who occupied the territory on the shores of the Mediterranean in what was ancient Liguria, say from Toulon to Genoa. The two figures are dressed in a loose costume of leather. The master founder pours the metal from a crucible, held by means of a large pair of tongs made of bronze, which is a reproduction of such an implement discovered in one of these foundries and now at the Musèe of St. Germain. The metal is represented as boiling in the mold. The crucible and mold are copied after originals in St. Germain. By the side of the workmen are pieces of bronze, broken ready to be melted, while on the other side a dozen or more new hatchets are laid out apparently ready for sale.

The amount of work bestowed upon this, as well as the other groups, in order to make them faithful representations of originals, must have been great, and their success is a high testimony to the gentlemen who conceived and executed it.

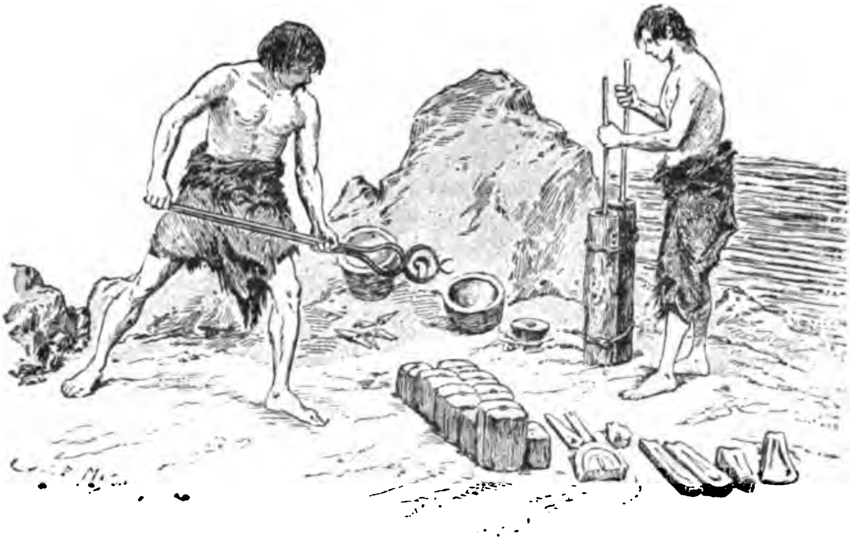
I may be pardoned for a few words explanatory of the extent of this industry and the age or civilization to which it belonged, by which I tell that there have been discovered in France alone fifty-seven such foundries, that the implements of bronze, broken and made ready for melting, number among the thousands, the implements found among the ten thousands, and the new objects deposited in *caches*, evidently never used and ready for sale, have been found in many places. The great foundry at Bologna had 14,000 pieces of broken implements for a like purpose, and weighing several thousand pounds.

### THE IRON AGE.

Two men, life-size, were at work with the forge, beating and hammering, working the iron. One, the assistant, helper he is called in the trade, blew the bellows, the other was the master-workman. The bellows consisted of two skin bags with a bit of iron pipe or tube tied in the mouth of each laid flat upon the ground, the two nozzles coming together. The alternate motion of these two bags like the working of an accordeon kept a continuous stream of air flowing from the (one or the other) nozzles which fed the fire on the ground and so heated the

REPRESENTATION OF A GROUP OF PREHISTORIC MEN.

(Neolithic, or polished stone age.)



REPRESENTATION OF A GROUP OF PREHISTORIC MEN.

(Age of bronze.)

iron. The anvil was about 2 inches long and 1 inch wide, driven into a block of wood which in its turn was driven firmly in the ground, the whole affair being not more than 5 or 6 inches above the level of the ground. This was the most primitive blacksmith shop I had ever seen, and it interested me much, but my interest was redoubled when on going through the Esplanade des Invalides in the colony of Senegal I came upon the same machine, same workshop, with the same furniture and tools and implements, and all worked in the same way.

Another of these life-size groups constructed and displayed in the court of the section of anthropology was from our own continent. It represented the Aztecs in old Mexico in the act of preparing the agave plant and making it into fiber to be woven into cloth (Plate CLXI). The agave plant is the American aloe, and there were many of them planted around and in the neighborhood of the Mexican colony. It serves many purposes of livelihood for the poor people, probably not now so much as in times of antiquity. It made their fences or hedges, the trunks of its trees made their houses, its leaves served for ropes, it made thread of the long fiber, and needles of the sharp points. The interior of leaves, the juicy part, produces alcoholic liquor, and it can be formed into the fiber of which their textile fabrics were made. The two life-size figures, the one engaged in beating, the other in rolling or bruising the agave plant fiber, were believed to be correct representations of the Aztec people at the time of the discovery of America by Columbus.

### SOCIETY OF ANTHROPOLOGY OF PARIS.

This society made a separate display under the protection of the minister of public instruction.

The objects displayed under the direction of the Society of Anthropology occupied a large space in the grand hall in the second story of he main building in the department of the minister of public instruc- on. Its classification was as follows:

#### I.—ANATOMIC ANTHROPOLOGY.

(1) **Society** of Autopsy, (2) Cerebral Morphology, (3) Histology of Cerebral Con-
lutions, (4) Craniology, (5) Osteology, (6) Comparative Splanchology, (7) Myol-
y, (8) **Anthropogeny.**

#### II.—PREHISTORIC ANTHROPOLOGY.

(1) **Geologic** Palethnology, (2) Mineralogic Palethnology, (3) Ages of Stone.
assification, (4) Processes of fabrication of the various forms of implements, (5)
e of **Metal,** (6) Paleoanthropology—prehistoric skulls and skeletons, (7) Trepana-
n, (8) **Agriculture** of Palethnology, (9) Methods of Excavation.

#### III.—ETHNOGRAPHY.

1) **Algeria** and Tunis, (2) Central Asia, (3) Malacca, (4) Indo-China and Cam-
lia, (5) **Cochin** China, (6) United States of America, (7) Venezuela, (8) Miscella-
us.

#### IV.—HISTORY OF RELIGIONS.

1) **Amulets,** (2) Divinities.

### V.—DEMOGRAPHY.

**(1) Anthropometry, (2) Medical Geography.**

### VI.—BIBLIOGRAPHY.

**(1) Books, (2) Maps, (3) Charts, etc.**

The first section of the first division was autopsy, and with it cerebral morhology. Here were displayed the brains of the following gentlemen who had belonged to the society of autopsy, and as such their brains had been dissected in the laboratory. The peculiarities and anatomic description were attached to each one:

Jules Assezat, died 1876, aged 45 years.
Louis Asseline, died 1878, aged 49 years.
Dr. Coudereau, died 1882, aged 50 years.
M. Gambetta, died 1882, aged 43 years.
Dr. Adolph Bertillon, died 1883, aged 62 years.
Gillet-Vital, died at 63 years of age.

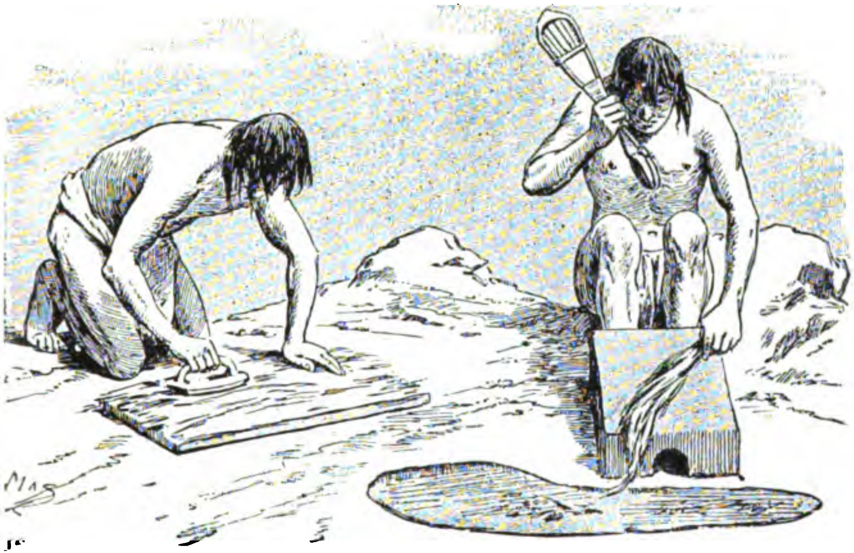
Charts were shown in which some of these brains were superposed, notably that of Dr. Bertillon and Leon Gambetta, so that one could compare them.

In the section of cerebral morphology was displayed a chart of the brain of decapitated assassins, of imbeciles, and anthropoid apes. Another was the encephalic profile of four specimens, two gorillas, an adult and one of 2 or 3 years; two humans, an adult and an infant of 2 years. These various designs were made by the stereograph, and were so superposed that one could see the differences between them. Each one was represented, and yet one could see plainly the difference between them.

In craniology not only full tables and charts were shown, but there were practical illustrations, by means of natural specimens, of the differences in the cephalic index in the human race, and also the differences in the different races. This made an exceedingly interesting and valuable display. There were numerous tables and charts, full of information as to the cranial form, capacity, deformity, etc., of the different races of men, and of as many different kinds in the same race as was possible, and these compared again with the anthropoid apes. Along with them were displayed the anthropometric instruments by which the measurements were to be made.

In osteology were tables and charts at great length, in great detail with many figures, giving full and complete information in relation to various portions of the human skeleton: sometimes in relation to itself and to other members of the same family; at other times compared with those of the higher quadrupeds.

For example, one showed the relative development of the different portions of the body according to sex, race, age, and height: the relation between the long bones and the height of man, the method measuring the long bones and thus determining the relation between



REPRESENTATION OF AZTECS WORKING THE AGAVE PLANT.

them and the height:—showing the relation between man and the anthropoid apes in relation to flattening of the tibia, the development of the different organs and functions in the two sexes. The remarkable thing about this chart was that it demonstrated that the weight of the brain is relatively greater in women than in men.

Splanchnology was represented by the internal organs of man and gorilla compared.

Anthropogeny was illustrated by six charts taken from the atlas of Monsieur Mathias Duval, representing his theory of the commencement of life in man. These charts represented the ovum of many animals, including man, in their various stages of impregnation, so that the differences could be easily compared and studied. He opposes fiercely the doctrine of heredity laid down by Weisman, Turner, and their school.

Prehistoric anthropology had an extensive display made in great detail, yet with the number of specimens reduced so as to employ as small a space as possible. The classification was that of Monsieur D'Ault du Mesnil, which was a variation of the classification of de Mortillet. It began with the quaternary inferior corresponding to the Chellèen of M. de Mortillet, the contemporaneous animals being the *Elephas antiquus*, *Rhinoceros merkii*, *Hippopotamus amphibius*, and so went through the various stages or epochs until it ended in the reindeer—this for the paleolithic period. Samples and specimens were shown of the fauna, and of the human industry in each. To describe it satisfactorily would be to write an entire book upon the science. It was continued through the various epochs and periods of the age of stone down to and including that of the Neolithic or polished stone. The mineralogy of prehistoric anthropology also received attention, and specimens of the various kinds of stone or minerals employed were displayed. Processes of the fabrication and the working of minerals of stone were also shown.

A small series of the implements characteristic of the age of bronze were also exhibited.

Prehistoric craniology received due attention and was represented by the casts of the skulls of the various races which were divided, first, into the great periods of paleolithic and neolithic, and these again divided and subdivided according to the best information.

Trepanation was not forgotten. Several specimens were shown, together with the means by which it might have been practiced.

Prehistoric agriculture had a fine representation in its display of cultivated fruits, cereals, and vegetables with the textile plant.

Not the least interesting of the entire prehistoric display in the exposition was that showing the proper methods for making excavations. This was even more important because of its result. By means of these investigations were determined the superposition of one civilization upon another in the various caverns which had been occupied for a long time as human habitations. Thus was determined the succession of occupations, consequently the succession of industries, of civilizations, and so of races. These were shown in detail and with satisfaction. I had visited many of the places here described and was acquainted with several localities, and it was to me an intensely interesting exhibit. It showed the successive ages of prehistoric civilization in a most satisfactory and convincing manner.

The department of ethnography was fairly well represented, but I only mention two; one the exposition made by M. Boban from North America, those which had been given to him by the Smithsonian Institution, and which I recognized as having been selected by myself. The second was the display from the Koekenmmoddens of Cambodia, and now interesting because the National Museum has just purchased a similar series from that country which were there displayed.

The history of religion figures largely in the science of anthropology. It was well represented in the exhibition of the school of anthropology. It will serve for a separate paper.

Anthropometry was illustrated by several charts, showing the various measurements, especially of France, but also of other and adjoining countries.

Medical geography illustrated by charts the various condition of France from different points of view.

*Bibliography.*—There was a library of the principal works published in France of late years bearing upon the subject of anthropology and prehistoric archæology.

## DENMARK.

In the little corner room from the pavilion, just beyond it on the right, entering from the Buddha, was installed the anthropologic display of Denmark. The government called to its aid three scientists, who are at the head of important departments of the Royal Museum of Antiquities in the Prince's palace at Copenhagen. Dr. Sophus Müller was charged with that portion of the exposition relating to prehistoric archæology; Mr. Kristian Bahnson with the second part, relating to the ethnography of Greenland; and Mr. Soren Hansen with the third, anthropology in general. All these sections were wonderfully prepared and united admirably in forming a comprehensive display of the great science.

Denmark was the seat of the discovery of the existence of prehistoric man. In 1807 the first public museum was organized for the reception and display of prehistoric antiquities, at Copenhagen; and here, and then, was announced for the first time that chronologic division of the prehistoric times into the ages of stone, bronze, and iron. This was the work of Mr. Thomsen. He commenced his work in that country in 1816 as founder of the great prehistoric museum of northern antiquities. He held the position of curator and did the work belonging thereto for 50 years, and this great museum, with its extensive and wonderful riches, the result of his life's work, is his monument.

The coadjutor of Thomsen was Worsaae, who during his life's work of 25 years did more probably than any other one man, a scientist and not particularly a discoverer, to establish the science of prehistoric anthropology on a firm basis.

Engelhardt, Steenstrup, and Thomsen were the early ones. To them must be given the honor of being the discoverers of prehistoric man. But Worsaae used these discoveries with the rarest genius and talent. It was not simply in prehistoric anthropology his talent was shown, for he was an all round man, who did admirable work in other branches of the great science, and not content with that, was called in his later years to be a councillor in the cabinet of the king, and there showed that rare combination, an illustrious scientist and a profound and sensible statesman.

The names of others can not be given in this paper. It will be enough if we can but mention their work. A systematic exploration, survey, and map have been commenced of the prehistoric monuments of Denmark. The archæologists are charged with this, and they, accompanied by good artists, are traveling and working over the country in order to make this map with all accuracy in both art and science. One-third of the entire country has been thus surveyed and more than one-third of this great work has been completed. All the monuments have been discovered, designated, drawn, and the most of them are in the hands of the engravers. One thousand five hundred of these monuments are now placed under the protection of the law, either as property of the government or under prohibition to destroy them without giving the government the first right of purchase. Four great leaves of this archæologic map of Denmark were displayed upon the walls, and I confess the feeling of envy of them and the regret that my own country has not such a map. I was only consoled by the hope that the Bureau of Ethnology would soon have completed the linguistic map which is in progress under its direction.

These four Danish charts of the archæological monuments represented the Islands of Möen, a part of the Seeland, the east of Jutland, and a part of its interior.

A library containing all or nearly all the Danish books upon the subject of prehistoric anthropology was displayed in the cases in this department, and the organizers thereof were very free in their commendations of the private collectors and individuals who had so willingly given of their riches to secure success at the exposition.

Dr. Sophus Müller thus expresses his appreciation of the patriotic feeling of the Danish people in making contribution to the need of the governmental display at the French Exposition:

> The Danish archæological display gives a good idea of the patriotic principles of our country, as it is composed for the greatest part of contributions from private col-

> lections. They have felt it a duty that our country should be dignifiedly represented at Paris, where is reunited this year the International Congress of Archæology and Anthropology, and they were pleased to offer to the committee their best and most precious objects. The number of objects offered were even so great that it would itself form a small museum. But the space which had been reserved for us by the committee of the Exposition was too limited and it would have been an impossibility that all could be accepted. For this cause the objects exposed were much too many; but on the other side, what we lost in quantity we made up in quality. It shows that our country possesses the best and the most interesting objects belonging to prehistoric archæology.

The age of stone in Denmark, indeed in Scandinavia, is divided by the scientists of those countries into two parts. The earliest was that of the Kjoekkenmoeddings, where the implements were rough and rude, small, and comparatively insignificant. But it was the age of polished stone. The second epoch of the age of stone comprised those magnificent and beautiful examples of flint chipping found in that country. The paleolithic age is not represented in Scandinavia. No objects belonging to that period have been found there, and it is believed by all that it was uninhabited during that period. But in the implements of the neolithic period that country was especially rich. There were the polished hatchets, the large tranchets of flint, again the small ones, the scrapers, the perforators, and the hatchets of deer horn. These have all been found in, and are supposed to belong to, the Kjoekkenmoeddings, and represent the first stage of polished stone in that country. I can scarcely attempt to describe the beauty and grandeur of the display of the second period of the age of stone. One must have seen the magnificent specimens of that country in order to appreciate or even understand what is meant by their grand display. I can only name at hazard, without attempting to describe the display. There were nucleii and the hammer stones, the long blades and flakes of flint, the exceedingly large and long stone hatchets shown in all the stages of their manufacture, from the first flake struck from the rock to the finely polished and finished hatchet of extraordinary length. The finely chipped poignards, with the ridges in their handles worked herring-bone fashion, blades long, thin, sharp; spear and lance heads of the same style, the flint flaked almost like shavings, from the edge to the center, and done with a regularity which would seem impossible but for the specimens now before our eyes. Arrowheads in profusion and of every possible form, shape, and style of manufacture. Each one of these particular forms, where there was anything peculiar about it, was represented by three examples, one of which was chipped ready for polishing; another, polished, which was new and had never served, and a third, a specimen which was more or less used. There were other series arranged in the same manner: scrapers, knives, chisels, club-heads, all the sort of implements and weapons belonging to that same age; scrapers, and pottery of various forms and ornamentation.

The polished-stone age in Denmark is most instructive and interesting. The number of implements of this period have filled the public and private collections and are a source of pride to all. The variety and elegance of form, the perfection and surprising management of the fashioning, provoke the greatest admiration. The principal reason for the excellence in Denmark lies in the superior quality of the flint of that country, and the ease with which it could be worked. If we consider the geographic formation of the country and the little islands which are surrounded by the numerous fiords that have favored such things, we may understand the circumstances which gave birth to and favored the development of a civilization which was comparatively well advanced. This age is supposed to have endured for about 2,500 years and to have come to an end from 1,500 to 2,000 years B. C., when it was supplanted by the age of bronze. This age was correspondingly well represented. It is but small wonder that Denmark should have furnished those profound students who have made such wonderful progress in the science of prehistoric anthropology. Its richness in antiquities is surprising and can not be understood without being seen, and the more it is seen and studied the more surprising and bewildering it becomes in number, extent, and beauty. Not to mention more than the word amber, would be to give a theme which, to be exhaustive, would require an entire book. The museum at Copenhagen possesses now over 200 discoveries of amber wrought by the prehistoric man as his ornaments for personal decoration. Four-fifths of these came from the Island of Jutland, but the rest were fairly well distributed around the various coasts. To follow out the commercial relations between the Scandinavian and other prehistoric countries by means of its trade in amber would require more space than could be devoted in this paper. Wherever in Europe prehistoric man of this epoch has been found, amber has been found with him, and it is believed that nearly all of it came from the North Sea and was exchanged for the objects, implements, and weapons of a foreign country. It is believed that the commerce in amber can be traced back to a period commencing 1,000 years before Christ. Numerous cases of amber were displayed in this Exposition.

Of the bronze age there were many specimens. The bars or ingots of bronze, rough and rude, the molds for casting hatchets and saws, hatchets of all kinds, knives, saws, sickles, razors, pinchers, arrowheads, swords, poignards, trumpets, spearheads, rings, fibula, etc., were there shown in all perfection; in all their beauty and wealth of form and compass. One case was devoted to vases, of gold, of bronze, of wood; some of them are ornamented with tin inlaid, having the appearance of the ware of the Japanese. The metal work was some of it hammered, some repoussé, some cast. The ornamentation was of the style of the bronze age, geometric design, made by points and lines.

Two exceedingly interesting specimens in the Danish display, that impressed themselves with greater ease upon the understanding and memory of those who saw them and gave them, at less expenditure of of thought, a better understanding of the prehistoric man of that country during the bronze age, were the two figures, reproductions of a warrior and a woman, dressed in the costume of the period, being a reproduction of like objects possessed by the museum at Copenhagen. The warrior wore a bonnet upon his head; it was round, and made of double cloth; no seams were shown. His body was covered with a square piece of cloth coming down to the knees and bound around by different straps and thongs, tied at the back. He wore a mantle upon his shoulders which fastened at the neck with a fibula of bronze. His feet were covered with sandals bound across the top with cord; he had a leather belt, which was fastened with a button of bronze ornamented with a piece of incrusted amber. On his arm was a gold ring, and he held in his hand a sword of bronze.

The woman wore upon her head a net, which was in a sufficient state of preservation when found to enable them to imitate the fabrication. It was made by simple interlacing of threads. Her jacket was a single piece of stuff which was originally too short and had been added to—pieced as it were. Her petticoat was made without being cut and was sewed only to bring the two ends together. Her cloak, which fastened with a hook, was ornamented in different colors, different designs being used in an ingenious manner of twisting the thread. All the jewelry which she had—the collar, the clasp to her cloak, the bronze bracelet, and the gold ring were reproduced in the forms which have been found to be the most frequent. She carried by her side a small poniard in a wooden scabbard.

In the reproduction of these objects the musée had employed the veritable bronze; one part tin and nine parts copper. These dresses were made by Madame Klein, director of the Academy of Art and Industries for Women, who has studied them minutely in their original production, and she and her scholars have produced them with minute exactness. The color was the only thing about which there was doubt, for, be it understood, that all these objects were found in, and came from, tombs, and from having lain either in wooden coffins, or by contact with the earth, have become a dark brown or possibly a black. I have one of these pieces from the same place out of one of these tombs. The nearest description I can give of its color would be a butternut.

The age of iron was represented, a full series of the ethnography of Greenland, together with all the books and specimens presented or gathered by that celebrated and well-known ardent scientist and anthropologist, Mr. Soren Hansen. One of the most important work done by anthropologists in later years in relation to America has been that accomplished by this gentleman, and he had at this display an example of his work. Many years ago Lund, who was himself a naturalist, being in the plains and caverns of Samidouro, Brazil, made some anthropologic discoveries in regard to the prehistoric man, and being unable to make studies of them himself, or, may be, having completed them, sent them to Copenhagen. They were lost in transit and did not arrive for some time after. Upon their arrival they were unrecognized, and it was not until the last 3 or 4 years that these valuable relics were discovered by Mr. Hansen, brought to light, investigated, compared, measured, and the result made known to the world. He thinks from these investigations that there is evidence at least of the possibility of man having existed in South America in the Tertiary period, and in this, I believe M. de Quatrefages, the most conservative of all European anthropologists, coincides, except as to the geology or paleontology—whether the Tertiary epoch of America is not one period behind that of Europe. This question has, I believe, received little attention from the American paleontologists, except Professor Cope, and he doubts the correctness of the conclusion. If he be correct, it puts the appearance of man in South America at the greatest antiquity probably of any other well-defined discovery of the kind.

The age of bronze came to an end in Scandinavia about the commencement of the Christian era, but the age of iron or its first use began some centuries before that. These ages necessarily lap one over the other. The prehistoric iron age in Scandinavia was divided into three grand epochs before the commencement of the historic period which was about the year 1000. These were the epochs of the barbarian.

At the far end of the pavillion was exhibited a great runic stone, which, as shown by its inscriptions in ancient runes, recounts the exploits of Harald Vlaatan, who lived from 935 to 986 A. D., and to his illustrious parent, Gorm, the first historic king of Denmark and to his queen, Thyra.

Neither time nor space permits a description of the other two departments of the Danish display—the ethnography of Greenland and Mr. Hansen's display of anthropology.

Mr. Waldemar Schmidt had the immediate charge of this exposition, and he, as many others, attended on each specified occasion to open cases, display objects, explain them, and make the necessary speeches and lectures for the education and edification of the public. These gentlemen have recognized the great advantage to be derived from anthropometry in their anthropologic studies both of prehistoric and modern Greenland. Therefore they have organized their governmental commissions for the purpose of carrying on these studies. More than three thousand Greenlanders have been measured, weighed, and tested with the exactness peculiar to the science of anthropometry. The walls were covered with charts of anthropometric measurements, showing in great detail the difference of height, average, and extremes, the color of the hair and eyes, and the effect in these respects of the crossing of the races of the Danes and Greenlanders and Eskimos.

## SPAIN.

Spanish prehistoric archæology was represented in four cases, being selections from the collection of MM. Henry and Louis Siret, No. 11 rue Joseph, Antwerp, Belgium. These gentlemen (brothers) made extensive exploration in the province of Carthagena, in the southeast of Spain, which they published in a magnificent album. I had the pleasure to visit their house and examine their collection at Antwerp. Their collection represented the neolithic period, the bronze age, and the period of transition from one to the other. There were arms, implements, and ornaments in stone and bone, immense vases of pottery, some of which were used for burial by inhumation. The usual bronze implements and objects were shown. There were sepultures of various kinds, and fragments of clothing made of linen cloth were found with the bodies. Agriculture and industries had large representation.

## SWITZERLAND.

Switzerland was represented by the collection of Mr. Valentine Schmidt. There were the usual objects belonging to the neolithic period and found in connection with the lake dwellings of that epoch. While the objects were choice and well selected, and consequently of beauty and importance, there was nothing remarkable about them more than one can find in good museums.

## BELGIUM.

Belgium had a representation of fifty cases devoted to prehistoric anthropology and archæology, though the occupation represented may have come down somewhat into the commencement of historic times. That portion of their display which they called ethnology was devoted almost exclusively to the crania and skeletons of prehistoric men, but which they carried over to ethnology because of the exhibition of the specimens of Neanderthal, Engis, Spy, Cro-Magnon, Furfooz, Sclaigneaux, Antwerp, Selzæte, with some individuals from Frankish cemeteries.

The paleolithic period was well represented, and this in some of its earliest manifestations, for the occupation of Belgium by prehistoric man seems to have begun at as early a period as that of any other country of Europe. A principal depot of this early occupation is at Mesvin, near Mons (Hainault). There were many pieces of flint displayed from this depot, which is believed by some of the Belgian prehistoric archæologists to belong to the very earliest quaternary geologic period, and to have been earlier than the depots at either Chelles or St. Acheul.

In objects belonging to the cavern period—mammoth and reindeer—southern Belgium is especially rich. The rivers Meuse, Lesse, and Sambre have many caverns in the ravines along their banks, and they were largely occupied by man in this early antiquity. The representation of the geography of this country and of the caverns was exceedingly elaborate, and the display of objects therefrom very rich.

M. Dupont continued in 1872 the excavations of caverns in that country which were begun by Schmerling 35 or 40 years before, and MM. de Puydt, Fraipont and Lohest took it up in 1884 where M. Dupont had left it. These gentlemen made many investigations and excavations in the caverns of the Lesse and Meuse, but the principal one was at the Grotte de Spy, a few miles northwest from the city of Dinant, where were found the celebrated skulls and skeletons of prehistoric man. Not only did these discoveries verify those of Schmerling and Dupont, and establish with greater certainty the existence of the paleolithic period and the human occupation during that period in the numberless caverns of that locality; but it served to emphasize our knowledge concerning the race of men belonging thereto. The discoveries at Neanderthal and Canstadt were only of human skulls, but that of Spy included much of the skeleton, and has done more than probably any other to give us an accurate knowledge of the anatomy and osteology, and of the size and form of this, the man of greatest antiquity whose remains have yet been found.

The Belgian display was worthy of much commendation. Not only was it quite complete, but its arrangement was excellent. The student, as he passed along, could comprehend and understand the science which it illustrated and the sequence of the specimens displayed. Maps were displayed upon the walls which showed the various prehistoric stations and the different periods and epochs to which they belonged. With lithographs, drawings, and photographs the various caverns of southern Belgium were well illustrated. La Naulette, Pont-a-Lesse, Montaigle, Furfooz, Chaleux, Hastiere were shown in their geographic position, by a general view, three sections, longitudinal, and transverse. The cavern of Spy was shown in much the same way, but, being more modern and considered more important, it was given in greater detail. A section was given both ways, showing the various strata in the cavern, while in the case below were laid out a series of objects found in each stratum. This was continued in a similar manner in many other of the caverns. By these means one could study the prehistoric archæology of Belgium in great detail and with much certainty.

The neolithic period was occupied principally with the great quarry at Spiennes. I had visited it and studied it under the guidance of M. Cornet, now unhappily deceased, and this display was particularly gratifying to me. Many excavations have been made in this quarry, and it and the workshop have been so studied as to be understood in all its relations to the prehistoric man. These excavations had been carefully designed at the time, and the designs, together with the objects found, were here laid out before the beholder.

These labors so conscientiously done in respect of the prehistoric stations mentioned, were extended with greater or less success over almost the entire country, and what surprised me was that in northern Belgium, in the neighborhood of Ghent, and between it and Antwerp, have been lately found enough of the prehistoric objects to establish the human occupation of that country in prehistoric times.

## HISTORY OF WRITING.

The study of inscriptions has demonstrated the relationship between the various forms of the alphabet, and has enabled the student to follow their transformation from their origin to modern times. An attempt was made at the French Exposition by Monsieur Philip Berger to collect the principal forms of writing in antiquity, and to give a résumé of their progress and relationship.

### CLASSIFICATION.

#### I.—*Pictographic.*

On dolmens and stone monuments of western Europe.
Scandinavia.
North American Indian.
Eskimo.
Oceanica.
- Messages:
  - Sticks, feathers, knots, etc.

#### II.—*Hieroglyphic.*

- Cuneiform:
  - Sumero-Akkadian.
    - Babylonian.
    - Assyrian.
    - Persian.
    - Scythian.

Egyptian.
Hittites.
Chinese.
Mayas.
Mexican.
Easter Island.

#### III.—*Alphabetic.*

- Semitic:
  - Phœnician.
  - Punic.
  - Neopunic.
  - Ancient Hebrew.
- Aramean:
  - Nabatean.
  - Palmyrean.
  - Hebrew Carrè.
  - Syrian.
- Arabic.
  - Himyarite.
  - Ethiopian.
- European:
  - Etruscan.
  - Greek Archaic.
  - Latin Archaic.
  - Scandinavian.
    - Runic stones, first and second period.
  - Ogham stones, Ireland.
  - Gaul.
  - Saxon
  - British.
- Hindoo:
  - Sanscrit.
  - Bactrian.

### PICTOGRAPHIC WRITING.

No discovery or invention had so great an effect upon the development of human civilization as that of writing. The invention of writing was the debut of history. Writing made history possible. Although we have no knowledge of the actual beginning of writing, we may suppose it to have been by picture writing. This certainly was the earliest of which we know. It was called pictography, and gave but little more than the rudiments of the idea intended to be recorded. The pictographic inscriptions found on the most ancient monuments of the stone age have a marked resemblance to those we find to-day among savages who live in a corresponding state of civilization. It employed usually a mixture of images borrowed from animal life, and of figures which were after a fashion geometric.

Pictographic writing seems to have spread over almost the entire surface of the globe. Pictographs are to be found in almost every country. There was no single system of pictography. Each nation or tribe, even each family or person, may have established a code for itself or may have followed no code. They may have been governed in making pictographs more by fantasy or caprice than anything else. Pictographs have been found of the highest antiquity in Asia and in Europe, while they are still employed in Africa, Oceanica, and among the North American Indians. The works of Col. Garrick Mallery in the Bureau of Ethnology are standards for the latter.

Fig. 1 of Pl. CLXII represents the engraving of the covering stone of a small dolmen at Baker Hill in Rosshire, Scotland, from Mr. Simpson. This represents the cup marking of nearly every kind, some of which have been found in almost every part of the globe.

Fig. 2 of Pl. CLXII, is an engraving on one of the granite supports of the dolmen of Petit-Mont at Arzon, Morbihan. Two human feet are represented and many undulated lines. Some of those which are continuous have been taken to be serpents, but there is no more reason for this than is shown by the lines themselves. There are two open U's, which is a common sign in that country. Another, equally common, is the crook just below the U's. They are sometimes with the crook turned to the right, sometimes to the left, and are occasionally arranged in groups, one following the other. They resemble a figure 7, sometimes placed right and sometimes reversed.

Fig. 3 of Pl. CLXII is an engraved support of the dolmen of Gavr'Inis, Morbihan. This dolmen was under a tumulus. It consisted of a rectangular chamber with a long covered entry-way extending nearly to the periphery of the tumulus. It is of granite slabs, which were nearly all engraved similar to the one shown, though not intended to be copies or exact imitations.

These are all one twenty-fifth natural size.

Pl. CLXIII represents a slab of granite one-fifth natural size from the dolmen of Gavr'Inis, Morbihan, on which is engraved in deep lines the outline of a polished stone hatchet with its handle. This has been so protected from weathering by being under the tumulus as that it is not degraded and has been cited as one of the evidences of that manner of handling the polished stone hatchet.

The display of pictographic writing at the French Exposition was as follows:

1. Marks on the dolmen of Men-er-Hroek, Morbihan, France. (Cast.)
2. Rock carving at Skebbervall, Bohuslan, Sweden. (Cast.)
3. Modern—An Indian petition claiming the possession of certain lakes. The original is in the Museum of Santiago, Chili. A cast given by Dr. Meyer, of Dresden.

4 and 5. Inscriptions from Easter Island, engraved on wood.

6 and 6*a*. Mayas writing from Yucatan—inscription from the steps of the temple of Palenque. From the Musèe Trocadero. (Cast.)

7. Mexican writing—a mixture of pictographs and hieroglyphs. Dedication of the grand temple by Ahuitzotl.

   This bas-relief represented the king laying the corner-stone. Above and below appeared the date, of which a translation has been attempted, viz: "The day 7 Roseau, 13 of the month Itzeallt Xochilluit of the year Eight Roseaux (Feb. 19th, 1487)." Cast. The original at the National Museum, Mexico.

## HIEROGLYPHIC WRITING.

When the pictographic system had so progressed that each picture represented an idea, and when made after a given design, it represented the same idea continuously, the art of writing was born. This was ideography, and was thus named because it rendered the ideas of the writer, by signs, the meaning of which was fixed or had been agreed upon. The ideas to be expressed were naturally of great number, and the ideographs became complicated. It was called hieroglyphic because it was practiced principally by the priests—the hierarchy. The term "hieroglyphic" was applied first to the ancient Egyptian writing, but afterwards to all analogous systems.

The ideographic or hieroglyphic system extended to many nations or peoples, but the codes of hieroglyphs were different. The principal hieroglyphic writings were the Chinese, Egyptian, Assyrian, or Cuneiform, and Hittites in the eastern hemisphere; and the Aztecs and Mayas in the western.

The resources of language and the needs of writers caused the introduction of other signs and characters, which completed the ideographic signs and added precision to their sense. Thus it came that some of the ancient writing employed all three of the systems; the ancient Egyptian writing was at the same time hieroglyphic and alphabetic.

The first growth by which written language came into being is unknown. It is surmised that because of the needs of people for the recording of facts, or for the transmission of messages, some system

PLATE CLXII.

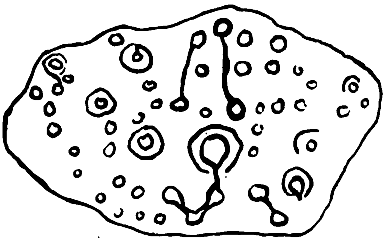


Fig. 1.

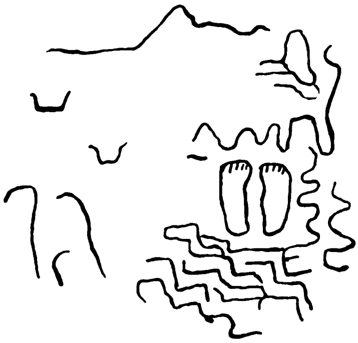


Fig. 2.

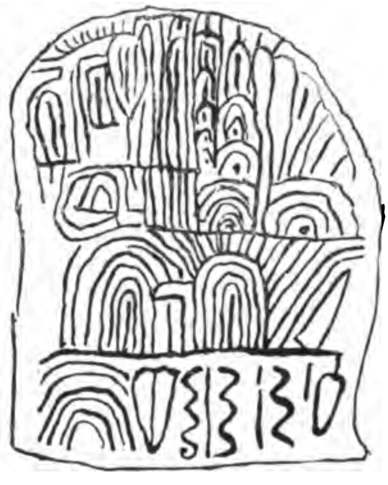
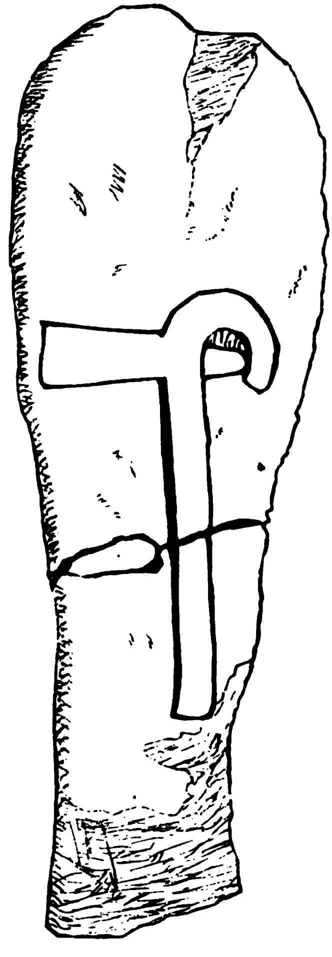


Fig. 3.

FIG. 1. Engraving on stone of dolmen. (Ross-shire, Scotland. From Archaic sculpturing. From Simpson, Plate XIV.)
FIG. 2. Engraving on support of dolmen. (Petit-mont, Arzon, Morbihan, France.)
FIG. 3. Specimens of engravings on supports of dolmen. (Gavr'Inis, Morbihan, France.)



PICTOGRAPH. POLISHED STONE HATCHET.

(Dolmen of Gavr'Inis, Morbihan, France. One-third natural size.)

should be invented, and thus, little by little, the art of writing grew to its present perfection. In the hieroglyphic system each sign represented an idea which, being in the mind of the maker, would be recognized and understood by the reader.

For the specimens of Chinese hieroglyphic writing the visitor was requested to see the adjoining section in ethnography, where Chinese industries, arts, etc., especially that of printing, were displayed at length.

*Cuneiform writing.*—Cuneiform writing was, like that of the Chinese, composed in its origin of figures that have become, little by little, unrecognizable. Their primitive form is found in the most ancient Chaldean inscriptions. The principal varieties of Cuneiform writings are the Chaldean, which lasted until the fall of Babylon. The Assyrian and Persian seem to have been simplified from an Arian language.

8 and 8½. Bricks from Babylon. One bearing the seal of Nebuchadnezzar stamped in the soft brick before it was burnt. Translation—"Nebuchaduezzar, King of Babylon, King of Nations, Grand King, Servant of the Great God, Restorer of the Towers and the Pyramids, I." One showing the bitumen still attached which had served as cement.

9. Assyrian writing—Obelisk of Nimrod, built by Salmanazar II, about 860 B. C.

This celebrated monument represents the kings bringing tribute and making submission to Salmanazar. Men are carrying bars of precious metal. There are the elephant, horse, camel, and gigantic apes. Among the tributaries shown in the second register is the King of Israel Jehu prostrate before the feet of the King of Assyria. Underneath is the legend: Jehoua bin Omri (Jehu Son of Omri). Cast. The original is in the British Museum.

*Hittite Hieroglyphs.*—These are anterior to the year 1000 B. C.

10. Lion found by his excellency Hamdg-bey at Marach, Asia Minor. Cast given by the Musée of Ethnography of Trocadero. The original is at the Imperial Museum, Constantinople.

It is scarcely 20 years since the discovery of the first inscription of these characters. Since then the number has increased, but without being yet deciphered. It appears to have been used before the invention of the alphabet by the people on the borders of Syria. On this lion one can see the gross hieroglyphic characters covering its body.

*Egyptian writing.*—Egyptian writing is the most perfect of the hieroglyphic system. It was the forerunner of the alphabet. It is presented in three forms—the writing hieroglyphic, hieratic, and demotic. The ieroglyphs have preserved with a remarkable fidelity the primitive orm of the ancient ideographs, which, on the contrary, disappear lmost entirely in the hieratic and demotic writing. The latter are the orms most altered from the hieroglyphs. The most celebrated speci-nen of this system was the

.1. Rosetta stone, with its corresponding paragraphs in hieroglyphic, demotic, and Greek, each being a translation of the other.

This was found in 1799, during the French expedition to Egypt, by an officer of artillery named Boussard. The name of the King—Ptolemy—was recognized in each, or at least in two of the writings, and thus caused the discovery of their similarity and lead to the deciphering of the hieroglyphs by Champollion. Cast given by the British Museum, which possesses the original.

### ALPHABETIC WRITING.

About the year 1500 B. C., that is about or before the time of Moses, the alphabet made its appearance among the Phœnician and afterwards among the Hebrew peoples on the Syrian coast. It would seem to have been only a simplification of Egyptian writing, adapted to the needs of commerce. The Phœnicians borrowed from the great mass of Egyptian hieroglyphics about twenty signs corresponding to the principal articulatory sounds of human speech. This was a radical transformation of the art of writing. We can believe that it was of much greater import than supposed by its discoverers. It changed for all the world and for all time the power of man over his civilization by giving him the ability to record, communicate and perpetuate his knowledge. Monsieur Renan declares the discovery of alphabetic writing to be the highest testimony of the genius of man. Capacity to utter articulate sounds is limited, so a very few characters were sufficient to record them, and it was not difficult, the discovery once made, to render all of man's ideas and to give every shade of his thought. These signs formed the alphabet of writing.

The Phœnician alphabet was modest in its commencement, but it finished by triumphing over all other systems, and has imposed itself upon all civilized peoples. It gave birth to all the semitic alphabets, from the Hebrew to the Syrian and Arabic, yet they employed only the consonants. It gave birth to the Greek alphabet in which was created the vowels, and was thereupon communicated to the Etruscans, the Latins, the Slav and Germanic peoples, and so all over Europe.

The Greeks, after some hesitation and trial, finally determined for all these languages and peoples the system of alphabetic writing from left to right. The Phenician alphabet spread to the east and south, as well as to the north and west. It gave birth to the Aramean, to the ancient Hindoo, and so to the modern alphabets of India. Indeed with the exception of China and Japan, and their dependencies, to all those of Asia. Whatever of ideographic or hieroglyphic writing these peoples may have employed, they, with the exception noted, only used an alphabet descended from the twenty-two letters of the Phenician.

The alphabetic writing descending from the Phœnician alphabet is divided into three branches:

(1) The Semitic alphabet, which is written from right to left and has no vowel. The principal of these are the Phœnician, from which is derived the Punic and Neopunic, the ancient Hebrew, the Aramean, which gave birth to the Nabatean, the Palmyrenian, the Hebrew Carré, the Syriac and the Arabian, and finally the alphabet Himyarite and Ethiopian.

(2) The European alphabets which are all derived from the ancient Phœnician by the intermediation of the Greek.

(3) The alphabets of India and of Pehlevi, which descended at a comparatively recent date from the Aramean.

### 1. SEMITIC ALPHABET.

#### *Hebrew alphabet.*

12. Pillar Daibon; with an inscription of Mésa, king of Moab, about 875 B. C.
    This is placed at the head because of its importance, for it is one of the most ancient alphabetic inscriptions known (but see Mr. W. Flinder Petrie's discoveries of 1889 at Kahun, in which he finds many possibly alphabetic signs of the XIIth dynasty, 2600 B. C.). One can recognize in the foregoing inscription the relationship of different Hebrew letters with those of the Phœnician and Archaic-Greek alphabets. Cast given by the Louvre Museum, which possesses the original.

#### *Phœnician alphabet.*

13. Bronze cup dedicated to Baal Lebanon (the god of Lebanon), by King Hiram, 800 to 1000 B. C. The original is at the Bibliothèque Nationale (Cabinet des Médailles).
14. An inscription engraved on one of the colossuses of Ipsamboul by a mercenary of Psammetic, 650 to 600 B. C. Cast.
15. Cyprus. Inscription bilingual, Phœnician and Cyprian of Idalie of the year 4 of the King Melekjaton, 375 B. C. Cast from the original in the British Museum.
16. Sardinia. An inscription trilingual on bronze, engraved on the base of an altar weighing 100 pounds, given to Esculapius by Clion.
17. Carthage. Punic writing anterior to 200 years B. C. An ex-voto to Tanit in form of a tower.
18. 1. *Idem.* Fragment of the tariff of sacrifices of Carthage.
    2. *Idem.* A dedication of a sacred abbatoir.
    3. Malta. Dedication of a temple of Gaulos.
    All casts.
19. Malta. A bilingual inscription, Phœnician and Greek, which furnished to Abbe Barthelemy, about 1760, the key to the Phœnician alphabet. 200 to 150 B. C. Cast. Gift of the Louvre Museum.
20. A funeral vase from the cemetery of Hatrumète (Sousse), Tunis; with inscription painted in characters of running hand. 156 to 50 B. C.
    Translation: "This urn contains the bones of Iataumelek, son of Bomilcar, son of Abdmelbari, the * * * ." Gift of Colonel Vincent.
21. Another funeral vase from the same cemetery, with painted inscription. Gift of Colonel Vincent.
22. Neopunic writing of the Roman epoch. Cabinet of *Corpus Inscriptionum Semiticarum.*

#### *Aramean alphabet.*

In its origin the Aramean alphabet is confounded with the Phœnician alphabet, which gave birth to it. But soon the tail to the letters were made longer, then were bent to the left that they might be joined to the following letters. At the same time the head of the letters became modified, and the writing took more the character of running hand, of which we find the complete development in the Arabic writing.

23. Ancient Aramean writing in relief. Inscription of Teima, Central Arabia, discovered by Mr. Ch. Huber, assassinated at Djedda in 1884. A pillar commemorative of the installation of the cult of the god Telem of Hagam at Teima. On the left side of the pillar is the image of the god, and below the priest, which makes him an offering upon an altar with the legend "Selemsazab, Priest." Cast, gift of the Louvre Museum.
24. An ancient Aramean inscription found by Ch. Huber at Teima.
25. Aramean inscription of the north of Arabia by Ch. Huber.
26. Aramean alphabet from Egypt. A funeral pillar from Vatican. Persian epoch 500 to 300 B. C. Cast given by M. Fr. Lenormant to the cabinet of *Corpus Inscriptionum Semiticarum.*
27. Nabatean writing, from 100 years B. C. to 300 A. D. In use by the population of the north of Arabia before the time of Mahomet. Original, found at Teina, Arabia. By Ch. Huber.
28. *Idem.*
29. Palmyrian inscription, bilingual, from the Musée du Capitol, 236 years A. D. This is a consecration of a silver statue to the gods Aglibol and Malakbel. Cast. Original the property of Marquis de Vogué.
30. Palmyrian inscription. A votive altar dedicated to the god Malakbel. Museum of the Capitol. Cast. Original the property of Marquis de Vogué.
31. Hebrew Carrè, about 150 B. C. Jewish inscription from Jaffa. Fifth or sixth century A. D. Cast.
32. Arabian writing. Specimens of manuscript Confique and Neskis, from the mosque Kairouan, Tunis.

### 2. EUROPEAN ALPHABET.

33. Archaic-Greek, derived from the ancient Phœnician. Treaty of the Arcadians with the *Eléens d'Hera* 600 to 500 B. C. Facsimile. The original is engraved on a bronze plate.
34. Archaic-Greek. The law of Gortyne, 500 B. C. An inscription boustrophedon, that is to say, going alternately from right to left and from left to right. Cast, gift of the Louvre Museum.
35. Etruscan inscription. Cast, gift of Louvre Museum.
36. Archaic-Latin, derived from the Phœnician by the intermediation of the Greek. Bronze placque discovered in 1866–'67 near Gibraltar. Decree of Paul Em. according liberty to the slaves of the Hastenses who occupied the tower of Lasceta, then the property of their town and territory. 190 B. C. Cast, gift of the Louvre Museum.
37. Trilingual inscription; Greek, Latin, and Phœnician. Engraved on the base of a bronze altar of the weight of 100 pounds. This was an offering to the great Doctor Esculapius (Esmoun Merre), by Clion. "Because he heard his voice and was cured." 150 to 130 B. C. Heliogravure from Sardinia. A cast of the original was shown in the Phœnician section, No. 16.
38. An Equestrian incription of the time of the Republic. Cast from the Louvre Museum.

The runic characters of Scandinavia are probably the latest manifestation of the alphabetic writing in antiquity. It may be called the last fossil alphabetic writing. They had two grand epochs or divisions both of which, however, belonged to the iron age. The characters were essentially different, so much so that a knowledge of one does not enable one to read the other. The more ancient is the most difficult. The earliest one dates from before the Christian era to about 400 A. D.; the second begins with the fifth century and continues to the beginning of history, and corresponds to the Viking period.

### 3. INDIAN ALPHABETS.

39. Sanscrit. Indian alphabet d'Acoka. Semitic origin which gave birth to the Dévanagari, and to all the modern alphabets of India. Third century B. C. Facsimile of inscription of Bhabra, after M. Senart, Asiatic Journal, April–June, 1887.
40. Alphabet Indo-Bactrien from the northwest of India, derived from the Aramean. Facsimile of an inscription dated the second year of Kanichka. First century A. D.

HIMYARITE ALPHABET.—*Writing of the ancient people of South Arabia from third century B. C. to third century A. D.*

41. A votive altar. Incense burner.
42. *Idem.*
43. Dedication of a statue of gold to the God Talab-Ryam by a family of Raidanites in recognition of the aid he had given to them in a war between the tribes of Saba and Raitan against their enemies the Himyarites.
44. An inscription with bas-relief. The heads of the three personages are shown. Their names are given in the inscription. Translation: Tomb of Yahmad Kachfankan, Harat, and Khalkarib.
45. Votive inscription; pedestal. Cabinet *Corpus inscription Semiticarum.*
46. Berber writing. A funerary bilingual inscription; Latin and Berber. Corp. Inscr. Sem.

47 and 48. Neopunic inscription with bas-reliefs. Corp. Inscr. Sem.

49. Bas-relief, fragment from Teima, Arabia. By Ch. Huber. Original.

In order to complete the chart of the ancient writing Philip Berger made an attempt at the reconstitution of a Phœnician pillar with its ornaments and accessories.

50. Reconstitution of the pillar of Byblos, Phœnicia.

This pillar bears an inscription commemorative of the construction of a portion of the temple of Byblos by the Yehaumelek. Above the inscription is a bas-relief representing the scene of the dedication. The Goddess "Lady of Byblos (Baalat Gebal)" is seated on a throne. She is represented after the character or appearance of the Egyptian goddess Hathor. Her head-dress is of two wings of the Guinea fowl which surmount two horns supporting a disk. In her left hand is a scepter, while her right is raised in sign of benediction. Opposite the king is Yehaumelek in Persian costume standing, and in the posture of prayer, offers to the goddess the "cup of deliverance." The inscription explains the scene. It enumerates the constructions made by the king to the goddess, because every time that he had invoked her aid, she had heard his prayers and had answered them for his good. The inscription terminates with a prayer of the king in which he invokes the benediction of the goddess on him and his reign. "For he is a just king."

The restorations were, first, the disk of gold surrounded by serpents that was inserted at the top of the bas-relief; second, the two horns supporting a disk which surmounts the monument; third, the traces of color on the bas-relief; the vase of libations with its two elegant handles.

This pillar is placed on two lions of stone, which were found at the same time and in the same place, and which evidently had formed part of the monument. These lions were loaned for this purpose by their owner, M. de Clercq, who kindly gave permission to make the casts of the pillar, and assisted in the reconstruction of the monument.

It might be of interest and value to continue this history of writing by quotations or condensations from the latest literature upon the subject, among which might be mentioned the history of the alphabet by Canon Isaac Taylor, Rosny's Les Ecritures Figuratives des Différents Peuples Anciens et Modernes, and Essai sur la Propagation de l'Alphabet Phenicien dans l'Ancien Monde, by M. Francois Lenormant, but the purpose of this paper being rather a report upon anthropology at the French Exposition, would not admit thereof. I can not, however, conclude this subject without calling to the attention of the reader the late discoveries made by Mr. W. Flinders Petrie at Kahun in the Fayum, Egypt, of many hundred specimens of marks or characters upon the pottery, and occasionally upon the wooden toys, ornaments, or implements found by him and assigned to the period of the twelfth dynasty, 2600 B. C., and identified by the pyramids built by Usertesen II. I have mentioned those marks in my description of these Egyptian objects purchased by me from Mr. Petrie at London, and now displayed in the National Museum. Tracings of some of them are shown in Fig. 99.

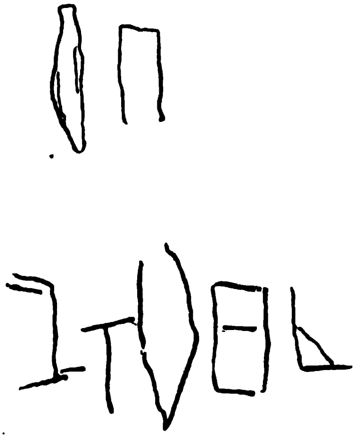


FIG. 99.—Possible alphabetic characters. (From Kahun, twelfth dynasty, Egypt. Discovered by Mr. Flinders Petrie. Probably the earliest alphabetic characters known—2600 B. C.)

## AMULETS.

The polished stone hatchet is recognized almost all over Europe as an amulet protective against lightning. It is called in many languages "the stone of lightning," or "thunder stone." This belief pervades western Europe, and it is no uncommon thing for peasants to deny any knowledge of the polished stone hatchet, because they do not know it by that name. Many of these hatchets were drilled for suspension. In this way they were intended to be carried sometimes about the neck or on the person, or occasionally are hung at the bed head or near it, with other votive offerings. When not drilled, they are put in any ledge in the stones of the fireplace, occasionally laid upon the mantel over the fireplace, or may be inserted in a crack at the outside of the door. The general belief is that these stones come from the heavens in the flash of lightning, and one person declared that his polished stone hatchet had descended therefrom in a streak of lightning in his presence, that he had seen it strike in the neighboring field, and upon his going to the place he found the hole and extracted therefrom this hatchet, *still hot*, and that he had kept it ever since. It is needless to say that he positively refused to part with it at any price.

The flint arrowheads come within the same category, and many times a flint chip is used to which is attributed the same virtue. The arrowheads were not drilled. Sometimes they were in their original condition, but many times they were mounted in silver and the mounting arranged with a ring for suspension. Drawings of these are given in Mr. John Evans's "Ancient Stone Implements of Great Britain," in de Mortillet, Cartailhac, etc.

In Brittany a common amulet, but one of great power and regarded with great veneration, is the one called the *pierre du croix*, the staurolite by the United States mineralogists, but staurotite by the French; a mineral which crystallizes in the form of a cross, not always at right angles, but frequently so. This is regarded as a token from God in favor of the religion of the country, and is given to these his chosen people as a recognition of their piety and religious fervor. There are several quarries of these in Brittany, one near Auray. There they are gathered and mounted by the jewelers and sold as amulets. I saw in the jeweler's window in one of the streets of that town a slab of mineral containing these staurotites embedded therein in their natural state. It was about 12 inches wide and 16 inches long and had in it, if I remember rightly, forty or fifty of these specimens. It was regarded with great veneration, would not be sold at any price, but, nevertheless, was exposed in the window and served as a sign by which the owner did a good business at selling the single ones mounted.

There were others of the same nature, which are crystallized in the star shape, and they are regarded in the same way. We have in the National Museum full series of both kinds, some from the United States and others from Europe. They are considered as a talisman against shipwreck, drowning, and hydrophobia, and are a cure for sore eyes. When not mounted as a pin or a ring, they are placed in a small sachet or bag and so worn occasionally around the neck or in the pocket. They are of various sizes and lengths, from an inch down to less than a quarter.

In Italy the coral is an amulet to guard its owner against the evil eye.

These are the principal objects. The others dwindle in importance, but are, of course, considerable in number and much relied on for their efficacy and virtue.

Beads, pearls, etc., are used as amulets. Common ground glass in facets is a favorite. These are shaped as beads and are arranged on a string and usually worn as a collar. A particular one at the exposition came from Locmariaquer, Morbihan. It was endowed with great medical properties. It was a cure for diseases of the throat, diphtheria, that kind of scrofula called the *Mal du roi*, because it is believed that this disease can be cured by the *roi* (king) if he simply touches the patient. There are beads of other material. This form seems to have a high reputation in this neighborhood. They should be of different materials in the same string or collar. Those of amber are precious and are considered of great value and virtue. I have myself three or four coming from that country, a half an inch long and five-eighths of an inch in diameter, which have been worn until half the substance has gone, when the holes have been filled with lead, bushed as one might say, and a new hole drilled. The standard number of beads on a string for the greatest efficacy is seven or nine, and to make them complete one should be of rock crystal. The belief of the peasants in the virtue of these is widespread. They are passed from hand to hand where needful throughout the country. Every midwife is provided with a string of these beads, and all careful mothers will provide or hire a string of them to be worn by their children as they approach the age of puberty.

Limonite concretions (*Pierre de la grossesse*) in the form of a hollow ball with detached pieces inside are of great virtue during gestation. The patella and similar shells are deemed of great benefit to nursing women and aiding in the secretion of the infantile food.

The common people of France, Belgium, Ireland, and other countries in Europe have a great veneration for their priests and a high regard for their religion. Therefore medals and votive offerings are employed extensively. These medals have been blessed by the mother-church and so are worn not as any particular talisman, but as an omen of good luck, a preventive against the powers of evil, and a constant reminder of one's vows to the church. They may be made in the form of a coin with a hole or ring, or they may be oval that they can bear an image of the Virgin. They are made of different metals, the most common being lead or zinc, then of silver and occasionally of gold.

The votive offerings given in thankfulness and remembrance of mercy and benefits received are many. Those, of course, could not be gathered and represented at the exposition, because they are deposited in the churches and other sacred places. Occasionally they may be found in the common churches, but the more sacred the church and the more renowned for its sanctity, the greater the number of these votive offerings. I have seen them in the church and at the spring of Madonna de la Laghetto, near La Turbie, on the mountain just above Monaco, and in the extreme southeast of France. They are to be found almost without number at the grotto and church of Lourdes in the extreme southwest of France, and I have seen them by the hundred in the church of Sainte

Anne d'Auray in the northwest of France. These votive offerings may be of almost any kind, from a picture or an illuminated writing down to the crutches and canes which have been thrown away because their need had ceased, the invalid having been cured by the miraculous interposition of the particular saint. The commonest votive offering is a representation of the particular part which had been effected and on which the cure was made. The foot, the arm, the head, or the leg may be reproduced in wax, in miniature, and suspended from the wall or framed in and around the statue of the particular saint to which the cure is ascribed. I have never counted the number thus exposed and do no more than to guess at it from their appearance. I should say of those thus exhibited at the Sainte Anne d'Auray, one thousand would be a moderate estimate. The collection of M. Bonnemere contained a number of these votive offerings from Belgium.

A favorite talisman in Brittany is a small key, cast or struck, and made usually of cheap metal, as is the medals. These keys and medals or charms represent the virtues of the different saints, and are supposed to carry with them efficacy from his blessing. They are found distributed throughout Brittany, and are for sale by the peddlers or merchants at all the fairs and *pardons* in the province. The people ascribe to each one key or medal its particular virtue. St. Eli and St. Anthony are guardian saints of all animals; St. Cornely is the guardian saint of horned cattle. On the road from Quimperlè to Pont Aven is a spring of St. Eli, and every peasant who passes gives his cattle or animals to drink of this spring. The church of St. Cornely is at Carnac, and in the harvest moon of August the cattle are driven by their owners to the churchyard and spring. They are decked with garlands and flowers and beautiful greens, and it is a grand holiday, or rather holinight. Cattle of the neighborhood, whenever sick or ailing, are driven to the well or this spring. If not able to go, the water will be carried to them.

Of the medals and coins, of which I spoke a moment ago as being sold throughout the country at the *pardons*, a particular one to be mentioned is that of St. Mathurin du Moncontour. It is in the form of a cone, round at the summit, the top of which is surmounted by a head with nimbus and terminates in a ring for suspension. It is in honor of the saint, who is supposed to have great power and authority. His chief virtue, however, would be regarded as that of self-denial, for it is generally believed that he *Aurait pu etre le bon Dieu s'il eut voulu mais il a craint que cela peut-etre lui causât trop de tracas*—might have been God if he had so willed, but he feared it would cause too much of a fracas.

There is told, in the Bulletin of the Société d'Anthropologie at Paris, a curious story of the curé of St. Brieuc, who distributed to the children of the parish some of the round ivory chips or disks used as counters for games of cards. These came in time to be regarded as amulets which the priest had blessed and, being carried by the children, were considered as a preventive of intestinal worms in children. They are called *Olifants*, and are sold at a comparatively high price. The wife of the letter-carrier at Cornay hired hers out at *vingt cinq centimes*—cents a seance or day. Among other things, they will cure broken ribs.

There were three private collections of amulets, charms, and talismans displayed at the exposition, and one of divinities. The former are the property of, and were collected by, M. Joseph Belucci of Perugia, Adrien de Mortillet of Paris, Lionel Bonnemere of Belgium; and the latter by Clement Rubbens.

They numbered from four hundred or five hundred pieces in a collection down to one hundred. They were arranged in proper order and with the classification and catalogue of their respective powers and localities.

# SECTION IV.

## BIBLIOGRAPHY OF THE U. S. NATIONAL MUSEUM DURING THE YEAR ENDING JUNE 30, 1890.

# BIBLIOGRAPHY OF THE U. S. NATIONAL MUSEUM, 1890.

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## I.—PUBLICATIONS OF THE MUSEUM.

**Annual Report | of the | Board of Regents | of the | Smithsonian Institution, | showing | the Operations, Expenditures, and Condition | of the Institution | for the | Year ending June 30, 1886. | — | Part II. | — | Washington: | Government Printing Office. | 1889.**

8vo. pp. viii+842. 20 plates and 22 text-figures.

**Annual Report | of the | Board of Regents | of the | Smithsonian Institution, | showing | the Operations, Expenditures, and Condition | of the Institution | for the | Year ending June 30, 1887. | — | Part II. | — | Washington: | Government Printing Office. | 1889.**

8vo. pp. xviii+771. 32 plates and 125 text figures.

**Smithsonian Institution. | United States National Museum. | — | Proceedings | of the | United States National Museum. | — | Vol. XI. | 1888. | — | Washington: | Government Printing Office. | 1889.**

8vo. pp. xi+703. Plates I-LX; figures 145.

**Smithsonian Institution. | United States National Museum. | — | Proceedings | of the | United States National Museum. | — | Vol. XII. | 1889. | — | Washington: | Government Printing Office. | 1890.**

8vo. pp. viii+686. Plates I-XXIII; figures 14.

The following signatures of Vol. XI were received during the year:

| Date of publication. | No. of signature. | Pages. | Date of publication. | No. of signature. | Pages. |
|---|---|---|---|---|---|
| July 5, 1889 | 20 | 1-16 | September 3, 1889 | 32 | 193-208 |
| Do | 21 | 17-32 | Do | 33 | 209-224 |
| Do | 22 | 33-48 | September 20, 1889 | 34 | 225-240 |
| Do | 23 | 49-64 | Do | 35 | 241-256 |
| Do | 24 | 65-80 | September 25, 1889 | 36 | 257-272 |
| Do | 25 | 81-96 | Do | 37 | 273-288 |
| Do | 26 | 97-112 | Do | 38 | 289-304 |
| Do | 27 | 113-128 | Do | 39 | 305-320 |
| September 3, 1889 | 28 | 129-144 | Do | 40 | 321-336 |
| Do | 29 | 145-160 | Do | 41 | 337-352 |
| Do | 30 | 161-176 | S$^{e}$ptember 27, 1889 | 42 | 353-368 |
| Do | 31 | 177-192 | | | |

During the year the system of issuing the proceedings by signatures was abolished, and commencing with Vol. XII, an edition of extras of each paper has been issued in pamphlet form, of which the following twenty-nine in number were published during the year:

| Date of publication. | No. of paper. | Pages. | Date of publication. | No. of paper. | Pages. |
|---|---|---|---|---|---|
| September 20, 1889 | 761 | 1-20 | March 6, 1890 | 776-777 | 367-376 |
| | 762 | 21-31 | March 7, 1890 | 778 | 377-386 |
| | 763 | 33-46 | April 3, 1890 | 779 | 387-451 |
| January 29, 1890 | 764 | 47-82 | March 22, 1890 | 780 | 453-454 |
| | 765 | 83-94 | April 19, 1890 | 781 | 455-496 |
| November 16, 1889 | 766 | 95-99 | May 22, 1890 | 782 | 497-504 |
| November 20, 1889 | 767 | 101-128 | May 15, 1890 | 783 | 505-600 |
| | 768 | 129-139 | May 17, 1890 | 784 | 601-617 |
| November 23, 1889 | 769 | 141-147 | | 785 | 619-634 |
| | 770 | 149-183 | May 15, 1890 | 786 | 635-640 |
| December 3, 1889 | 771 | 185-216 | July 3, 1890* | 787 | 641-642 |
| December 5, 1889 | 772 | 217-218 | July 31, 890* | 788 | 643-644 |
| March 6, 1890 | 773 | 219-362 | July 17, 1890* | 789 | 645-652 |
| February 18, 1890 | 774 | 363 | | | |
| | 775 | 365-366 | | | |

Smithsonian Institution. | United States National Museum. | (Serial Number 45) | Bulletin | of the | United States National Museum. | No. 34. | The Batrachia of North America. | By | E. D. Cope. | — | Washington: | Government Printing Office. | 1889.

8vo. pp. 525. Plates I-LXXXVI; figures 1-119.

Smithsonian Institution. | United States National Museum. | — | Bulletin | of the | United States National Museum. | No. 35. | Bibliographical Catalogue of the Described Transformations | of North American Lepidoptera. | By | Henry Edwards. | — | Washington: | Government Printing Office. | 1889

8vo. pp. 147.

Smithsonian Institution. | United States National Museum. | — | Bulletin | of the | United States National Museum. | No. 36. | Contributions to the Natural History of the Cetaceans, | a Review of the Family Delphinidæ. | By | Frederick W. True. | — | Washington: | Government Printing Office. | 1889.

8vo. pp. 191. Plates I-XLVII; 1 figure.

Smithsonian Institution: | United States National Museum. | — | Bulletin | of the | United States National Museum, | No. 37. | A Preliminary Catalogue of the Shell-Bearing Marine | Mollusks and Brachiopods of the Southeastern Coast of the United States, with Illus- | trations of Many of the Species. | By | William Healey Dall, A. M., | Honorary Curator, Department of Mollusks, U. S. National Museum. | — | Washington: | Government Printing Office. | 1889.

8vo. pp. 221. Plates I-LXXIV.

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*Advance copies received before July 1.

Smithsonian Institution: | United States National Museum, | — | Bulletin | of the | United States National Museum. | No. 38. | Contribution toward a Monograph of the Insects of | the Lepidopterous Family Noctuidæ of Temper- | ate North America. Revision of the | Species of the Genus Agrotis. | By | John B. Smith, | Professor of Entomology, Rutgers College, New Jersey. | — | Washington: Government Printing Office. | 1890.

8 vo. pp. 237. Plates I-V.

## II.—PAPERS BY OFFICERS OF THE NATIONAL MUSEUM AND OTHER INVESTIGATORS WHOSE WRITINGS ARE BASED DIRECTLY OR INDIRECTLY ON MUSEUM MATERIAL.

### ALPHABETICAL LIST OF NAMES.

Adler, Dr. Cyrus, Johns Hopkins University, Baltimore, Maryland; Assistant Curator, Section of Oriental Antiquities, U. S. National Museum.

Agassiz, Prof. Alexander, Museum of Comparative Zoölogy, Harvard College, Cambridge, Massachusetts.

Allen, Dr. Harrison, 1933 Chestnut street, Philadelphia, Pennsylvania.

Allen, Prof. J. A., American Museum of Natural History, New York City, New York.

Ashmead, William H., Jacksonville, Florida.

Baird, Prof. Spencer F., Secretary, Smithsonian Institution.

Batchelder, Charles F., Cambridge, Massachusetts.

Baur, Dr. G., Yale University Museum, New Haven, Connecticut.

Bean, Barton A., Assistant Curator, Department of Fishes, U. S. National Museum.

Bean, Dr. Tarleton H., U. S. Fish Commission; Honorary Curator, Department of Fishes, U. S. National Museum.

Bendire, Capt. Charles E., U. S. Army, Honorary Curator, Department of Birds' Eggs, U. S. National Museum.

Berlepsch, Hans von, Münden, Hanover, Germany.

Beyer, Dr. Henry Gustav, U. S. Navy, Honorary Curator, Section of Materia Medica, U. S. National Museum.

Binney, William G., Burlington, New Jersey.

Boas, Dr. Franz, 47 Lafayette Place, New York City, New York.

Bolles, Lieut. T. Dix, U. S. Navy, Washington, District of Columbia.

Bollman, Charles Harvey, Indiana State University, Bloomington, Indiana.

Bruner, Lawrence, Lincoln, Nebraska.

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Yeates, W. S., Assistant Curator, Department of Minerals, U. S. National Museum.

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## LIST OF PAPERS.

CYRUS ADLER. Assyriology in Japan.

*Proc. Amer. Orient. Soc.*, October, 1889, p. clxvii-f.

(Abstract, *Johns Hopkins University Circulars*, December, 1889, p. 28.)

Account of a Japanese scholar's views of the influence of Assyria on Chinese and Japanese art; discussion of the question of primitive relations between Babylon and China.

CYRUS ADLER. The Shofar; its use and origin.

*Proc. Amer. Orient. Soc.*, October, 1889, p. clxxi-ff.

(Abstract, *Johns Hopkins University Circulars*, December, 1889, p. 27 f.)

CYRUS ADLER. Notes on the Johns Hopkins and Abbot collections of Egyptian antiquities (with the translation of the two Coptic inscriptions by Mr. W. Max Müller).

*Proc. Amer. Orient. Soc.*, May, 1890.

**CYRUS ADLER.** Review of Renan's History of Israel.

*American*, August 3 and 10, 1889.

**CYRUS ADLER.** Review of Jastrow's Dictionary of the Talmud.

*American*, September 21, 1889.

**ALEXANDER AGASSIZ.** Ueber einen neuen Tiefsee-Crinoiden aus der Familie der Apiocriniden.

*Neues Jahrbuch für Mineralogie, Geologie und Palæontologie*, I, 1890, pp. 94–95.
Relates to specimens collected by the Fish Commission steamer *Albatross*, off the Galapagos Islands in 1888.

**HARRISON ALLEN.** Descriptions of two new species of Bats, *Nyctinomus europs* and *N. orthotis*.

*Proc. U. S. Nat. Mus.*, XII, No. 786, 1889, pp. 635–640.

**J. A. ALLEN.** To what extent is it profitable to recognize geographical forms among North American birds?

*The Auk*, VII, No. 1, January, 1890, pp. 1–9.

**WILLIAM H. ASHMEAD.** Descriptions of new *Ichneumonidæ* in the collection of the U. S. National Museum.

*Proc. U. S. Nat. Mus.*, XII, No. 779, 1889, pp. 387–451.

**WILLIAM H. ASHMEAD.** Descriptions of new *Braconidæ* in the collection of the U.S National Museum.

*Proc. U. S. Nat. Mus.*, XI, September 25, 1888 (1889), pp. 611–671.

**SPENCER F. BAIRD.** The Sea Fisheries of Eastern North America. Prepared for the consideration of the International Commission held at Halifax in 1877.

*Annual Report of the U. S. Commissioner of Fish and Fisheries*, pt. xiv, 1886 (1889), pp. 3-224.
Contains many references to the marine invertebrates of economic value occurring on the eastern coast of North America.

**C. F. BATCHELDER.** An undescribed subspecies of *Dryobates pubescens*.

*The Auk*, VI, No. 3, July, 1889, pp. 253–255. *Dryobates pubescens oreœcus*.

**G. BAUR.** The genera of the *Cheloniidæ*.

*The American Naturalist*, XXIV, May, 1890, pp. 486–487.
Diagnoses of the genera, and a brief discussion of the species of *Lepidochelys* and *Chelonia* based in part on material in the National Museum.

**BARTON A. BEAN.** [Ichthyological Notes in *Forest and Stream*.]

The Harvest Fish, XXXII, July 4, 1889, p. 494.
A Rare Deep-sea Fish, XXXIII, Sept. 12, 1889, p. 144.
Fish Breeding in Canada (review), XXXIII, pp. 149, 150. (From the report of Fish Breeding in the Dominion of Canada.)
Fish Culture in Illinois, XXXIII, September 12, 1889, p. 150.
Large-mouthed Black Bass in Texas, XXXIII, September 19, 1889, p. 167.
Double-headed Animals, XXXIII, September 19, 1889, p. 164.
The Cutlass Fish, XXXIII, September 19, 1889, p. 169.
Study of Fresh-water Food Fishes, XXXIII, September 26, 1889, p. 181.
A Land Fish, XXXIII, September 26, 1889, p. 186.
Susquehanna Bass and Perch, XXXIII, September 26, 1889, p. 186.
Missouri Fish Commission, XXXIII, October 10, 1889, p. 231. (A review of the Fifth Biennial Report of the Missouri Fish Commission for the year 1887–1888.)
Rhinoceros Hornbill, XXXIII, October 10, 1889, p. 224.
Salmon Fishing in Scotland (review), XXXIII, October 17, 1889, p. 247. (From the Seventh Annual Report of the Fishery Board for Scotland, 1888, part II, Salmon Fisheries. Edinburgh, 1889.)

**BARTON A. BEAN.** [Ichthyological Notes in *Shooting and Fishing*.]

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Large Plantings of Fish in the West, VII, December 19, 1889, p. 7.
Black Bass and Crappie for Eastern Waters, VII, December 12, 1889, p. 8.
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Black Bass Prospects in the Potomac, May 22, 1890.
Delaware River Shad Hatching, May 22, 1890.

TARLETON H. BEAN. Description of *Coregonus pusillus*, a new species of White fish from Alaska.

*Proc. U. S. Nat. Mus.*, XI, September 3, 1888, p. 526.

TARLETON H. BEAN. Scientific results of explorations by the U. S. Fish Commission steamer *Albatross*, No. VIII. Description of a new Cottoid fish from British Columbia.

*Proc. U. S. Nat. Mus.*, XII, March 4, 1890, pp. 641, 642.

(*Synchirinæ*, new family; *Synchirus gilli*, new genus and species.)

TARLETON H. BEAN. [Ichthyological Notes in *Forest and Stream*.]

An Eskimo Reloading Tool, XXXIV, January 23, 1890, p. 5.
The Salmon of Alaska, XXXIV, April 3, 1890, pp. 210, 211.
The Salmon of Alaska (concluded), XXXIV, April 10, 1890, p. 231.
The Silver Eel, XXXIII, November 14, 1889, p. 330.
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Sunapee Trout from Dan's Hole Pond, XXXIII, December 5, 1889, p. 390.
Fish of Florida Waters, XXXIII, January 9, 1890, pp. 487-491.
National Fish Culture, XXXIV, February 27, 1890, p. 102.
The Tautog, XXXIV, April 24, 1890, p. 271.
The Weakfish, XXXIV, May 8, 1890, p. 312.

TARLETON H. BEAN. Report on the Department of Fishes in the U. S. National Museum, 1886.

*Report of the Smithsonian Institution*, II, 1886 (1889), pp. 167-172.

TARLETON H. BEAN. Report on the Department of Fishes in the U. S. National Museum, 1887.

*Report of the Smithsonian Institution* (U. S. National Museum), 1887 (1889), pp. 105-110.

CHARLES E. BENDIRE. *Picicorvus columbianus* (Wils), Clarke's Nutcracker. Its nests and eggs, etc.

*The Auk*, VI, No. 3, July, 1889, pp. 226-236.

CHARLES E. BENDIRE. Description of the nest and eggs of *Megascops asio maxwelliæ*, the Rocky Mountain Screech Owl.

*The Auk*, VI, No. 4, October, 1889, pp. 278-302.

CHARLES E. BENDIRE. Notes on *Pipilo fuscus mesoleucus* and *Pipilo alberti*, their habits, nests, and eggs.

*The Auk*, VII, No. 1, January, 1890, pp. 22-29.

CHARLES E. BENDIRE. *Megascops asio maxwelliæ.*

*The Auk*, VII, No. 1, January, 1890, p. 91.

CHARLES E. BENDIRE. A second nest and eggs of *Picicorvus columbianus*, taken in Colorado.

*The Auk*, VII, No. 1, January, 1890, p. 92.

CHARLES E. BENDIRE. Report on the Section of Birds' Eggs in the U. S. National Museum, 1886.

*Report of the Smithsonian Institution* II, 1866 (1889), pp. 163-164.

CHARLES E. BENDIRE. Report on the Section of Birds' Eggs in the U. S. National Museum, 1887.

*Report of the Smithsonian Institution* (U. S. National Museum), 1887 (1889), pp. 101-102.

HANS VON BERLEPSCH. Notes on some Neotropical Birds belonging to the U. S. National Museum.

*Proc. U. S. Nat. Mus.*, XI, September 20, 1888 (1889), pp. 559-566.

(Relates chiefly to *Trochilidæ*.)

H. G. BEYER. Report on the Section of Materia Medica in the U. S. National Museum, 1886.

*Report of the Smithsonian Institution*, II, 1886 (1889), pp. 143-145.

WILLIAM G. BINNEY. A third supplement to the fifth volume of the terrestrial and air-breathing mollusks of the United States and adjacent territories.

*Bull. Mus. Comp. Zool.*, XIX, No. 4, 1890, pp. 183-226; pl. i-xi.

This paper, bringing up the data of the subject to date, is in part based on material in the U. S. National Museum where the types are deposited.

T. DIX BOLLES. A preliminary catalogue of the Eskimo Collection in the U. S. Nation Museum arranged geographically and by uses.

*Report of the Smithsonian Institution* (U. S. National Museum), 1887 (1889), pp. 335-365.

**Charles Harvey Bollman** and **David Starr Jordan.** List of Fishes colle at Green Turtle Cay in the Bahamas by Charles L. Edwards, with descriptio three new species.

*Proc. U. S. Nat. Mus.*, XI, September 20, 1888 (1889), pp. 549-553.

*Stilbiscus*, genus novum; *Gobiesox hæres*, *Sparisoma niphobles*, *Stilbiscus edwardsi* spe novæ.

(See also under David Starr Jordan.)

**Lawrence Bruner.** New North American *Acrididæ* found north of the Mexica boundary.

*Proc. U. S. Nat. Mus.*, XII, No. 764, 1889, pp. 47-82.

**Frank M. Chapman.** On the eastern forms of *Geothlypis trichas*.

*The Auk*, VII, No. 1, January, 1890, pp. 9-14.

*Geothlypis trichas ignota*, subspp. nov.

**Frank M. Chapman.** On the winter distribution of the Bobolink (*Dolichonyx ory vorus*), with remarks on its routes of migration.

*The Auk*, VII, No. 1, January, 1890, pp. 39-44.

(See also under Clarence B. Riker.)

**F. W. Clarke.** Administrative report as chief chemist.

*Eighth Annual Report of the U. S. Geological Survey*, 1886-'87 (1889), pp. 189-193.

**F. W. Clarke.** The calculation of atomic weights.

*Bull. Chem. Soc. of Washington*, No. 5, 1889-'90.

**F. W. Clarke.** A note on orthography and nomenclature.

*Chemical News*, LXI, 1890, p. 36.

**F. W. Clarke.** A report of work done in the Division of Chemistry and Phys mainly during the fiscal year 1886-1887.

*Bull. U. S. Geological Survey*, No. 55, 1889.

**F. W. Clarke.** A report of work done in the Division of Chemistry and Phys mainly during the fiscal year 1887-1888.

*Bull. U. S. Geological Survey*, No. 60, 1889.

**F. W. Clarke.** Quarterly abstracts of papers upon atomic weights.

*Journal of Analytical Chemistry.*

**F. W. Clarke.** "Element."

*Watts' Dictionary of Chemistry*, new edition (London), 1889, pp. 427-430.

**F. W. Clarke.** A new occurrence of Gyrolite.

*Amer. Jour. Sci.*, November, 1889, 200 Separates.

**F. W. Clarke.** A Theory of the Mica Group.

*Amer. Jour. Sci.*, November, 1889, 200 Separates.

**F. W. Clarke.** The relative abundance of the chemical elements.

*Bull. Phil. Soc. of Washington*, XI, p. 131.

**F. W. Clarke.** The meteorite collection in the U. S. National Museum; a catalo of meteorites represented November 1, 1886.

*Report of the Smithsonian Institution*, Part II, 1886 (1889), pp. 255-260.

**F. W. Clarke.** Review of Grove and Thorp's Chemical Technology.

*Public Opinion*, January 4, 1890.

**F. W. Clarke.** Report on the Department of Minerals in the U. S. National Mus 1886.

*Report of the Smithsonian Institution*, II, 1886 (1889), pp. 237-238.

**F. W. Clarke.** Report on the Department of Minerals in the U. S. National Mus 1887.

*Report of the Smithsonian Institution* (U. S. National Museum), 1887 (1889), pp. 149-150.

**F. W. Clarke** and **E. A. Schneider.** Ueber die chemische Constitution des Talk

*Berichte der Deutsch. Chem. Gesell.*, XXIII, p. 1537.

**J. W. Collins.** Suggestions for the employment of improved types of vessels i market fisheries, with notes on British fishing steamers.

*Bull. U. S. Fish Com.*, VIII, pp. 175-192, Pl. XVI-XXVII.

Discusses the types of vessels used in the fisheries and suggests improvements in their rig, etc. Also discusses steamers used in the fisheries of Great Britain, with a vi their introduction into this country.

The originals of some of the illustrations accompanying this paper will be incorporated the exhibits of the section of naval architecture in the U. S. National Museum.

J. W. Collins. Report upon the operations of the U. S. Fish Commission schooner *Grampus* from June 5, 1886, to March 15, 1887.

*Annual report of the U. S. Commissioner of Fish and Fisheries*, Part XIV, 1886 (1889), pp. 701-720.

Describes investigations off the eastern coast of the United States, during which many fishes and marine invertebrates were taken.

E. D. Cope. Scientific results of explorations by the U. S. Fish Commission steamer *Albatross* (published by permission of Col. Marshall McDonald, U. S. Commissioner of Fisheries). No. III. Report on the batrachians and reptiles collected in 1887-1888.

*Proc. U. S. Nat. Mus.*, XII, 1889 (1890), pp. 141-147.

Twenty-six species treated of, the following being described as new: *Zachænus roseus* from Patagonia, type U. S. Nat. Mus., No. 15126; *Paludicola frenata* from Chili, type No. 15129; *Phyllodactylus leei*, type No. 14957, and *Tropidurus lemniscatus*, type No. 14945, both from the Galapagos Islands.

E. D. Cope. The Batrachia of North America.

*Bull* 34, *U. S. Nat. Mus.*, 1889, 8 vo., pp. 1-525. pl. 1-lxxxvi; figs. 1-119.

Charles B. Cory. The Birds of the West Indies, including all species known to occur in the Bahama Islands and Greater Antilles, the Caymans, and the Lesser Antilles, excepting the Islands of Tobago and Trinidad. Published by Estes & Lauriat, Boston, Mass., 1889.

8 vo, pp. 324, 2 maps, and numerous wood-cuts in the text.

John Merle Coulter. Upon a collection of plants made by G. C. Nealley in the region of the Rio Grande, in Texas, from Brazos Santiago to El Paso County.

*Contributions from the U. S. National Herbarium*, I, No. 2, pp. 29-61.

Twenty-two new species and fifteen varieties are described by Coulter, Vasey, Scribner, and Vasey and Scribner.

John Merle Coulter and Joseph Nelson Rose. Notes on North American *Umbelliferæ*. I.

*The Botanical Gazette*, XIV, pp. 274-284.

Described as new, *Peucedanum Hassei*, *P. Torreyi*, *P. evittatum*, *P. Lemmoni*, *P. Plummeræ* *Eryngium Lemmoni*, *Eulophus Parishii*, var. *ternata*, *Carum Lemmoni*, *Tæniopleurum* (genus), and *T. Howellii*.

John Merle Coulter and Joseph Nelson Rose. Notes on North American *Umbelliferæ*. II.

*The Botanical Gazette*, XV, p. 259.

Described as new, *Hydrocotyle Bonariensis* var. *Texana*, *Arracacia Donnell-Smithii* (with plate).

John Merle Coulter and Joseph Nelson Rose. A new genus of *Umbelliferæ*.

*The Botanical Gazette*, XV, pp. 15-16.

*Donnellsmithia Guatemalensis* is described (with plate) as a new genus and species.

Frederick Vernon Coville. Revision of the United States species of the genus *Fuirena*.

*Bulletin of the Torrey Botanical Club*, XVII, pp. 1-18.

An early described form given a new name, *Fuirena squarrosa* var. *breviseta*; and the fruit of all the species figured.

William Healey Dall. A preliminary catalogue of the shell-bearing marine mollusks and brachiopods of the southeastern coast of the United States, with illustrations of many of the species.

*Bull.* 37, *U. S. Nat. Mus.*, 1889, 8vo, pp. 1-221, pl. i-lxxiv.

This publication comprises, besides the introductory remarks, a bibliography of literature relating to the mollusk fauna of the region; a sketch of the general arrangement; tables showing the bathymetric, geographic, and geologic distribution on the southeastern coast of the United States and adjacent region of the brachiopods, pelecypods, schaphopods, pteropods, shell-bearing gastropods, and cephalopods, with illustrations of six hundred and twenty species, by over a thousand figures on seventy-four plates. These are followed by a summary showing the standing of the various groups in relation to each other as exhibited by the tables; by a full explanation in detail of each plate, and a complete alphabetical index. The conclusion is reached that the fauna of this part of the coast includes about 1,635 shell-bearing mollusks, to which, if the naked gastropods, heteropods, and cephalopods were added, the total mollusk fauna, after all allowances were made, would probably reach at least 1,800 species. Although this volume is chiefly a catalogue and an

William Healey Dall—Continued.

iconography, it seems proper to call attention to the fact that the arrangement adopted includes very extensive revision of the classification until lately in common use, and an attempt has been made in the gastropods, as well as in the bivalves, to incorporate such changes as the progress of recent years has shown to be necessary or advisable, the result being something decidedly different from the obsolete classification to be found in most catalogues or manuals accessible to students.

William Healey Dall. Note on two *Helices* new to the fauna of the United States.

*The Nautilus*, III, No. 3, July, 1889, pp. 25, 26.

Determines the presence and distribution in Florida of *Helix* (*Microconus*) *cæca* Guppy and *H.* (*M*) *granum Strebel.*

William Healey Dall. On the genus *Corolla* (Dall.).

*The Nautilus*, III, No. 3, July, 1889, pp. 30, 31.

Shows that *Cymbuliopsis Pelseneer* is synonymous with *Corolla* Dall, and that the latter name should be adopted

William Healey Dall. Note on *Crepidula glauca* Say.

*The Nautilus*, III, No. 9, January, 1890, pp. 98, 99.

Shows that the shells commonly referred to *C. glauca* Say are either the depressed normal form of *C. convexa* Say, or young specimens of *C. fornicata* Lam, and that the name *glauca* had better be ignored in the future.

William Healey Dall. On a new species of *Tylodina.*

*The Nautilus*, III, No. 11, March, 1890, pp. 121, 122.

Shows that the mollusk obtained by the U. S. Fish Commission on the northern border of the Gulf of Mexico, off Florida, and a shell doubtfully referred to *Tylodina* or *Umbraculum* in the report on the gastropoda of the Blake expedition, are identical and form a species of *Tylodina* new to science, for which the name *T. americana* is proposed.

William Healey Dall. The Behring Sea controversy.

*New York Evening Post*, July 10, 1889.

A letter calling attention to certain historical facts bearing on the question.

William Healey Dall. Deep-sea mollusks and the conditions under which they exist.

*Proc. Biol. Soc. of Washington*, V, 1890, pp. 1-22.

An address delivered at the ninth anniversary meeting of the Biological Society of Washington, November 16, 1889.

William Healey Dall. On the hinge of Pelecypods and its development, with an attempt toward a better subdivision of the group.

*Amer. Jour. Sci.*, XXXVIII, December, 1889, pp. 445-462.

A paper discussing the dynamic genesis of hinge characters and proposing a new classification of the bivalve mollusks.

William Healey Dall. Bering.

*The Nation*, XLIX, No. 1275, December 5, 1889, p. 454.

A review of Lauridsen's Life of Bering, translated by J. E. Olson.

William Healey Dall. Scientific results of explorations by the U. S. Fish Commission steamer *Albatross*, No. VII. Preliminary report on the collection of mollusca and brachiopoda obtained in 1887-1888.

*Proc. U. S. Nat. Mus.*, XII, No. 773, March 7, 1890, pp. 219-362, pl. v-xiv.

This report comprises a discussion of the conditions of life in the deep sea, with special reference to their bearing on molluscan life; a discussion of the mechanics concerned in the hinge of bivalve mollusks and its development, with an attempt toward a better classification of the group, and lastly a report on the forms collected.

William Healey Dall. On dynamic influences in evolution.

*Proc. Biol. Soc. of Washington*, VI, pp. 1-10, issued separately May 8, 1890.

A statement of the author's position in regard to the views, sometimes termed Neo-Lamarckian, for which the term "dynamic evolution" is here proposed.

William Healey Dall. A critical review of Bering's first expedition, 1725-1730, together with a translation of his original report upon it, with a map.

*Nat. Geog. Mag.*, II, No. 2, June, 1890, pp. 1-57.

A review of the expedition, its causes, the circumstances under which it was made, the literature to which it gave rise, and an estimate of its geographical results, together with Bering's original report now first translated from the Russian language, and a facsimile of his first published chart.

WILLIAM HEALEY DALL. Types fossiles de l'Eocene du bassin de Paris, récemment découvertes en Amerique.

*Bull de la Soc. Zoöl. de France*, XV, June, 1890, pp. 97, 98.

Extract from a letter to Dr. Paul Fischer, communicated to the Society by the latter, announcing the discovery in the lowest Eocene of Alabama and Mississippi, conformably overlying the Upper Cretaceous, of gigantic species of *Cerithium* like those of the Paris basin. Also in the Lower Eocene of Texas of a species of *Terebellum* which, as well as the *Cerithium*, is a type hitherto unknown to the American Tertiary.

WILLIAM HEALEY DALL. Description of a new species of land-shell from Cuba, *Vertigo Cubana*.

*Proc. U. S. Nat. Mus.*, XII, No. 790, June, 1890, pp. 1, 2; figs. 1, 2.

A description of a remarkable species of *Vertigo* from the island of Cuba, of which the nearest is found in the Hawaiian Islands.

WILLIAM HEALEY DALL. Administrative report to the director of the U. S. Geological Survey.

*Eighth Annual Report of the U. S. Geological Survey*, 1886 (1890), pp. 181-184.

This comprises the annual report of the work of the Division of Cenozoic Paleontology of the U. S. Geological Survey, under the charge of the writer, as Paleontologist.

WILLIAM HEALEY DALL. Report on the Department of Mollusks (including Cenozoic Fossils) in the U. S. National Museum, 1886.

*Report of the Smithsonian Institution*, II, 1886, (1889), pp. 173-179.

WILLIAM HEALEY DALL. Report on the Department of Mollusks (including Cenozoic Fossils) in the U. S. National Museum, 1887.

*Report of the Smithsonian Institution* (U. S. National Museum), 1887 (1889), pp. 111-115.

FREDERIC P. DEWEY. Report on the Department of Metallurgy and Economic Geology in the U. S. National Museum, 1886.

*Report of the Smithsonian Institution*, II, 1886 (1889), pp. 245-252.

FREDERIC P. DEWEY. Report on the Department of Metallurgy and Economic Geology in the U. S. National Museum, 1887.

*Report of the Smithsonian Institution* (U. S. National Museum), 1887 (1889), pp. 155-158.

JONATHAN DWIGHT, JR. The Horned Larks of North America.

*The Auk*, VII, No 2, April, 1889, pp. 138-158, 8vo., 1 map.

*Otocoris alpestris adusta*, *O. a. merrilli*, and *O. a. pallida* Towns. subspp. nov.

HENRY EDWARDS. Bibliographical catalogue of the described transformations of North American Lepidoptera.

*Bull.* 35 *U. S. Nat. Mus.*, 1889, 8vo., pp. 1-147.

CARL H. and ROSA S. EIGENMANN. Notes on some California fishes, with descriptions of two new species.

*Proc. U. S. Nat. Mus.*, XI, Sept. 3, 1888, pp. 463-466.

*Gobius townsendi* sp. nov., and *Lepidogobius gilberti* sp. nov., are described for the first time.

CARL H. and ROSA S. EIGENMANN. On the genesis of the color cells of fishes.

*West Amer. Scientist*, July, 1889.

CARL H. and ROSA S. EIGENMANN. Notes from the San Diego Biological Laboratory, I. The fishes of Cortez Banks.

*West Amer. Scientist*, October, 1889.

CARL H. and ROSA S. EIGENMANN. Notes from the San Diego Biological Laboratory, II. 1. Additions to the fauna of Cortez Banks. 2. Additions to the fauna of San Diego, with notes on some rare species. 3. Fishes of Ætna Springs, Napa County, California. 4. Fishes of Allen Springs, Lake County, California. 5. The young stages of some Selachians.

*West Amer. Scientist*, November, 1889.

CARL H. and ROSA S. EIGENMANN. A review of the *Erythrininæ*.

*Proc. Cal. Acad. Sci.*, II, Nov. 8, 1889, (Ser. II).

CARL H. and ROSA S. EIGENMANN. A revision of the edentulous genera of *Curimatinæ*.

*Annals N. Y. Acad. Sci.*, IV, November, 1889.

CARL H. and ROSA S. EIGENMANN. Notes from the San Diego Biological Laboratory, III. 6. Additions to the fauna of San Diego.

*Proc. Cal. Acad. Sci.*, III, March, 1889, (Ser. II).

Carl H. and Rosa S. Eigenmann. Notes from the San Diego Biological Laboratory, III. 7. Description of a new species of *Euprotomicrus*.

*Proc. Cal. Acad. Sci.*, May 28, 1890.

Carl H. and Rosa S. Eigenmann. Notes from the San Diego Biological Laboratory, III. 8. Description of a new species of *Sebastodes*.

*Proc. Cal. Acad. Sci.*, May 28, 1890.

Carl H. and Rosa S. Eigenmann. Notes from the San Diego Biological Laboratory, III. 9. On the genus *Clevelandia*.

*Amer. Nat.*, October, 1889.

Carl H. and Rosa S. Eigenmann. Notes from the San Diego Biological Laboratory, III. 10. The development of *Micrometrus aggregatus*.

*Amer. Nat.*, October, 1889.

Carl H. and Rosa S. Eigenmann. Description of a fossil species of *Sebastodes*.

*Zoe*, I, No. 1, March, 1890, p. 16.

Carl H. and Rosa S. Eigenmann. Evolution of the cat-fishes.

*Zoe*, I, No. 1, March, 1890, pp. 10–15.

Carl H. and Rosa S. Eigenmann. The Barracuda.

*Zoe*, I, No. 2, April, 1890, p. 55.

Carl H. and Rosa S. Eigenmann. The Point Loma blind fish and its relatives.

*Zoe*, I, No. 3, May, 1890, pp. 65–72.

Carl H. and Rosa S. Eigenmann. Preliminary notes on South American *Nematognathi*.

*Cal. Acad. Sci.*, II, August 18, 1889.

Carl H. and Rosa S. Eigenmann. A review of the *Sciænidæ* of America and Europe.

*Report U. S. Commissioner of Fish and Fisheries*, 1886, pp. 343–451, pl. 4.

D. G. Elliott. A study of the genus *Dendrornis* and its species.

*The Auk*, VII, No. 2, April, 1890, pp. 160–189.

Barton W. Evermann. (See under David Starr Jordan).

Walter Faxon. Notes on North American Crayfishes, family *Astacidæ*.

*Proc. U. S. Nat. Mus.* XII, No. 785, 1889 (1890), pp. 619–634.

Thirty species are enumerated with notes and descriptions. One species, *Cambarus evermanni* is described as new. It is from the Escambia River at Flomaton, Florida. Nearly all of the species are represented in the collection of the National Museum.

J. Walter Fewkes. Report on the Medusæ collected by the U. S. Fish Commission steamer *Albatross* in the region of the Gulf Stream in 1885–'86.

*Annual Report of the U. S. Commissioner of Fish and Fisheries*, Part XIV, 1886 (1889), pp. 513–5[illegible] pl. 1.

One genus and two species are described as new. Other forms are described without being named, and full notes are given on some of the known species. The new genus and species are as follows: *Pleurophysa*, *Pleurophysa insignis*, *Pegantha*, sp.

Theodore Gill. The "Hatchery" of the sun-fish.

*Nature*, XL, p. 319, August 1, 1889.

Theodore Gill. Nest building of the sun-fish (*Lepominæ*).

*Forest and Stream*, XXXIII, August 8, 1889, p. 43.

Theodore Gill. Nesting of the black bass.

*Forest and Stream*, XXXIII, September 19, 1889, pp. 163–164.

Theodore Gill. On the classification of the mail-cheeked fishes.

*Proc. U. S. Nat. Mus.*, XI, September 25, 1888 (1889), pp. 567–592.

Theodore Gill. Gleanings among the *Pleuronectids*, and observations on the name *Pleuronectes*.

*Proc. U. S. Nat. Mus.*, XI, September 25, 1888 (1889), pp. 593–606.

Theodore Gill. Note on the genus *Spheroides*.

*Proc. U. S. Nat. Mus.*, XI, September 25, 1888 (1889), pp. 607–608.

Theodore Gill. The *Halosauroid* fishes typical of a special order (*Lyopomi*).

*American Naturalist*, XXIII, November, 1889, pp. 1015–1016.

Theodore Gill. The *Notacanthid* fishes as representatives of a peculiar order (*Heteromi*).

*American Naturalist*, XXIII, November, 1889, pp. 1016–1017.

Theodore Gill. The families of ribbon-fishes.

*American Naturalist*, XXIV, May, 1890, pp. 481–482.

CHARLES H. GILBERT. Description of a new species of *Bathymaster* (*B. jordani*) from Puget's Sound and Alaska.

*Proc. U S. Nat. Mus.*, XI, September 20, 1888 (1889), p. 554.

CHARLES H. GILBERT. A list of fishes from a small tributary of the Poteau River, Scott County, Arkansas.

*Proc. U. S. Nat. Mus.*, XI, September 25, 1888 (1889), pp. 609–610.

CHARLES H. GILBERT. Notes on the occurrence of *Gillichthys y-cauda* at San Francisco.

*Proc. U. S. Nat. Mus.*, XII, August 28, 1889, p. 363.

G. BROWN GOODE. The literary labors of Benjamin Franklin.

*Proceedings of the American Philosophical Society*, XXVII, 1890.

8vo. pp. 1–21.

An address delivered before the American Philosophical Society on April 17, 1890, on the occasion of the commemoration of the one hundredth anniversary of the decease of its illustrious founder and first president.

G. BROWN GOODE. The Origin of the National Scientific and Educational Institutions of the United States.

8vo. 1-112 (95–202).

Reprinted from the papers of the American Historical Association.

G. BROWN GOODE. Museum History and Museums of History.

8 vo., pp. 253 (497)-275 (519).

Read before the American Historical Association in Washington, D. C., December 26-28, 1888, and reprinted from the papers of the Association.

G. BROWN GOODE. The color of fishes.

*Science*, XV, No. 374, April 4, 1890, pp. 211-213, 3 text-figures.

Also printed in the Transactions of the American Fisheries Society.

G. BROWN GOODE. Report upon the condition and progress of the U. S. National Museum, 1886.

*Report of the Smithsonian Institution*, II, 1886 (1889), pp. VIII + 842.

G. BROWN GOODE. Report upon the condition and progress of the U. S. National Museum, 1887.

*Report of the Smithsonian Institution* (U. S. National Museum), 1887 (1889), pp. XVIII + 771.

J. H. GURNEY. The Northern Falcons.

*The Ibis*, I, ser. 6, January, 1889, pp. 143–144.

GILBERT D. HARRIS. Note on the occurrence of the genus *Terebellum* in American tertiary deposits.

*The American Geologist*, May, 1890, p. 315.

Note on the occurrence of a species of *Terebellum*, a genus hitherto unknown in the American tertiaries, in collections from the Eocene of Texas in the U. S. National Museum.

PAUL HAUPT. The Semitic sounds and their transliteration.

*Beitrage zur Assyriologie*, I, pp. 249-267.

Defines the character of the Semitic sounds and proposes a uniform system of transliteration.

PAUL HAUPT. The semi-vowel *u* and *i*.

*Beitrage zur Assyriologie*, I, pp. 293–300.

PAUL HAUPT. Additions and corrections.

*Beitrage zur Assyriologie*, I, pp. 313–329.

PAUL HAUPT. List of abbreviations.

*Beitrage zur Assyriologie*, I, pp. 362–368.

ROMYN HITCHCOCK. The preparation of Japanese lacquer and the manufacture of Wakasa lacquer ware.

*Proc. U. S. Nat. Mus.*, XI, September 3, 1888 (1889), pp. 473-479

ROMYN HITCHCOCK. The action of light on silver chloride.

*Amer. Chem. Jour.*, XI, October, 1889, pp. 474–480.

Very thin fibers of finely divided silver chloride were obtained on strips of thin glass and exposed to sunlight, some in a current of hydrogen, others in the free air. A loss of weight amounting to about 6 per cent of the chloride was observed. The experiments tend to prove that—

1. There is a loss of chlorine in sunlight amounting to at least 6 per cent.
2. The loss in weight is equal to the weight of chlorine set free, as shown by direct experiment.
3. There is no formation of oxychloride. The research is not complete, but the results have been established by subsequent work.

ROMYN HITCHCOCK. Shinto—the religion of the Japanese.

A general review of our knowledge of the original faith and mythology of the Japanese as set forth in the ancient records.

Not yet published in full. Abstract published in the Proceedings of the Am. Assn. Adv. Sci. August, 1889.

Read before Section H of the Amer. Assn. Adv. Sci., Toronto, August, 1889.

Read also before the Anthropological Society of Washington on November 4, 1889.

ROMYN HITCHCOCK. Notes on eclipse photography.

*Anthony's Photographic Bulletin*, XX, November 23, 1889, pp. 680–684.

Contains suggestions regarding the photographing of the corona; also a few notes on the appliances devised for the Eclipse Expedition to Japan in 1888.

ROMYN HITCHCOCK. Comparison of Eikonogen and Pyrogallol as photographic developers.

*Anthony's Photographic Bulletin*, XX, December 14, 1889, pp. 710–715.

ROMYN HITCHCOCK. A method of mounting photographic prints without cockling.

*Anthony's Photographic Bulletin*, XXI, February 8, 1890, pp. 74–76.

ROMYN HITCHCOCK. Preparation of microscopical mounts of vegetable textile fibers.

*Report of the Smithsonian Institution*, II, 1886 (1889), pp. 657, 658.

ROMYN HITCHCOCK. List of specimens of textiles and fabrics in the reference series of the Section of Textile Industries in the U. S. National Museum.

*Report of the Smithsonian Institution*, II, 1886 (1889), pp. 649–655.

ROMYN HITCHCOCK. Report on the Section of Foods and Textiles in the U. S. National Museum, 1886.

*Report of the Smithsonian Institution*, II, 1886 (1889), pp. 113–118.

THEODOR HOLM. Notes on *Hydrocotyle americana L.*

*Proc. U. S. Nat. Mus.*, XI, September 3, 1888 (1889), pp. 455–462. Two plates.

WILLIAM H. HOLMES. A quarry workshop of the flaked-stone implement-makers in the District of Columbia.

*The American Anthropologist*, III, No. 1, January, 1890, pp. 1–26.

This paper describes the explorations of an ancient quarry where quartzite bowlders were obtained for the manufacture of implements. It is shown that one form only was produced, a heavy leaf-shaped blade from 1 to 5 inches in length, and that this was probably the "blank" from which knives and arrow points were to be made. The conclusion is reached that there is no evidence pointing to the existence in the Potomac Valley of any other people than the Indian.

WILLIAM H. HOLMES. On the evolution of ornament—an American lesson.

*The American Anthropologist*, III, No. 2, April, 1890, pp. 137–146.

This is a discussion of the elementary stages of the decorative art, and especially of the influences exerted by technique in the textile and ceramic arts upon the forms of such natural objects as happened to be utilized in embellishment.

WILLIAM H. HOLMES. A West Virginia rock-shelter.

*The American Anthropologist*, III, No. 3, July, 1890, pp. 217–223.

The rock-shelter described owes its chief interest to the series of well preserved pictographs engraved and painted upon the walls. The work is comparatively recent and is attributed to the Algonkian peoples.

WILLIAM H. HOLMES. Report on the Section of American Aboriginal Pottery in the U. S. National Museum, 1886.

*Report of the Smithsonian Institution*, 1886 (1889), Part II, pp. 97–99.

WILLIAM H. HOLMES. Report on the Section of American Aboriginal Pottery in the U. S. National Museum, 1887.

*Report of the Smithsonian Institution* (U. S. National Museum), 1887 (1889), pp. 77, 78.

WILLIAM T. HORNADAY. How to collect mammal skins for purposes of study and for mounting.

*Report of the Smithsonian Institution*, II, 1886 (1889), pp. 659–670.

WILLIAM T. HORNADAY. The extermination of the American Bison.

*Report of the Smithsonian Institution* (U. S. National Museum), 1887 (1889), pp. 367–548.

WALTER HOUGH. Notes on the archæology of Easter Island.

*The American Naturalist*, XXIV, October, 1890, pp. 877–888.

Based on the collections of the U. S. S. *Mohican* in 1884.

Walter Hough. The preservation of museum specimens from insects and the effects of dampness.

*Report of the Smithsonian Institution* (U. S. National Museum), 1887 (1889), pp. 549–558, 4 figures.

Description of museum insect pests and treatment of specimens by preventives. Solutions for poisoning, and figures illustrating the apparatus used in applying poison.

Leland O. Howard. A newly imported elm insect.

*Insect Life*, II, August, 1889, pp. 34–41, 7 figures.

Announces the discovery in four localities in the United States of *Gossyparia ulmi* Geoff., a European Coccid. Describes and figures the different stages and brings out several new points in the life-history, from observations made by the author at Washington, and by Mr. J. G. Jack at Cambridge.

Leland O. Howard. Honors to American Entomology.

*Insect Life*, II, August, 1889, pp. 54, 55.

Announcement of Professor Riley's election as Hon. Fellow of the Entomological Society of London, with statement of other Americans previously so honored. Also announces that Professor Riley has been created Chevalier of the Legion of Honor.

Leland O. Howard. The hymenopterous parasites of North American butterflies, including a section upon the Microgasters by C. V. Riley.

*The butterflies of the eastern United States and Canada with especial reference to New England*, by S. H. Scudder, Part XII, October, 1889, pp. 1869–1911, Pl. 88, 89.

Comprises introduction, list of hosts and parasites, European hymenopterous parasites of butterflies common to Europe and North America, analytical table of families, analytical table of genera, descriptions of species. Sixty species are described, of which eighteen are new.

Leland O. Howard. Annotated catalogue of the insects collected in 1887–1888. Scientific results of explorations of the U. S. Fish Commission steamer *Albatross*.

*Proc. U. S. Nat. Mus.*, XII, December, 1880, pp. 185–216. Extra No. 771.

Contains lists of hemiptera identified by P. R. Uhler, orthoptera by L. Bruner, diptera by S. W. Williston, lepidoptera by W. J. Holland, mallophaga by H. Osborn, other insects by M. L. Linell, arachnida by G. Marx, myriapoda by C. H. Bollman

Leland O. Howard. Association of Economic Entomologists. First annual meeting.

*Insect Life*, II, December, 1889, pp. 177–184.

Full report of the meeting held in the rooms of the Department of Insects of the National Museum, November 12, 13, 14, 1889.

Leland O. Howard. Irrigation and injurious insects.

*Insect Life*, II, January and February, 1890, pp. 215–222.

A general summary of the influence of irrigation upon the ravages of injurious insects originally drawn up for the information of the Senate Committee on Irrigation.

Leland O. Howard. Some new parasites of the grain plant louse.

*Insect Life*, II, January and February, 1890, pp. 246–248, 3 figures.

Describes the following new species parasitic on *Siphonophora avenæ* Fabr.: *Pachyneuron micans*, *Megaspilus niger*, and *Encyrtus websteri*.

Leland O. Howard. A sketch of Professor Riley.

*The Farmer's Magazine* (London), I, Nos. 4, 5, January and February, 1890, pp. 237–241. Portrait.

A biographical sketch of C. V. Riley.

Leland O. Howard. A waspish love-struggle.

*Entomologica Americana*, VI, No. 2, February, 1890, p. 33.

Account of observations by Col. John Bowles on the curious polyandrous coition of a large vespid, probably either *Sphecius speciosus* or *Monedula carolina*.

Leland O. Howard. Two spider-egg parasites.

*Insect Life*, II, March, 1890, pp. 269–271, 2 figures.

Describes the following: *Acoloides* n. g. (*Proctotrupidæ*) *saitidis* n. sp. from eggs of *Saitis pulex*, and *Bæus americanus* n. sp. from undetermined eggs of an Epeirid.

Leland O. Howard. Note on the hairy eyes of some hymenoptera.

*Proc. Entom. Soc. Washington*, I, No. 4, May 15, 1890, pp. 195, 196.

Enumerates the families and genera of hymenoptera in which hairy eyes have been found, adds several to the list, and discusses the morphological significance and systematic value of these hairs.

LELAND O. HOWARD. Note on the mouth-parts of the American cockroach.

*Proc. Entom. Soc. Washington*, I, No. 4, May 15, 1890, pp. 216–218.

Describes in detail the mouth-parts of *Periplaneta americana* and particularly a sclerite in the form of a dentate digitus at the base of the tooth of the lacinia, heretofore unnoticed and not found in *P. orientalis*.

LELAND O. HOWARD. Authorship of the family *Mymaridæ*.

*Proc. Entom. Soc. Washington*, I, No. 4, May 15, 1890, p. 221.

Puts forth proof to show that Haliday (not Ashmead) is the original proposer of *Mymaridæ* as a family name.

LELAND O. HOWARD. A few additions and corrections to Scudder's Nomenclator Zoölogicus.

*Proc. Entom. Soc. Washington*, I, No. 4, May 15, 1890, pp. 258, 259.

LELAND O. HOWARD. Bibliography of American Economic Entomology.

*Insect Life*, II, May and June, 1890, p. 335.

Editorial notice of the publication and announcement of the scope of parts I, II, III, and index of the Bibliography of American Economic Entomology.

LELAND O. HOWARD. Additional note on spider-egg parasites.

*Insect Life*, II, May and June, 1890, p. 359.

Records the fact, communicated by Mr. W. H. Harrington, that *Trichasius clavatus* is a *Baeus* and gives additional localities for *B. americanus* and *Acoloides saitidis*.

LELAND O. HOWARD. A North American *Axima* and its habits.

*Insect Life*, II, May and June, 1890, pp. 365–367, 3 figures.

Discusses the relationships of *Axima* Walker and the validity of the subfamily *Aximinæ* Cameron and describes *Axima zabriskie* from North America, reared by Rev. J. L. Zabriskie from nests of *Ceratina dupla*. (See under Charles V. Riley.)

W. H. HUDSON. (See under P. L. Sclater.)

JOSEPH F. JAMES. On the Maquoketa shales and their correlation with the Cincinnati group of southwestern Ohio.

*Amer. Geol.*, V, 1890, pp. 335–356; postscript on p. 394.

This paper presents a review of the references to the shales of Iowa and the adjoining States. It also presents the results of a visit made to the typical locality in Iowa, discusses the extension of the Cincinnati series westward, as shown by the records of deep wells, and notes the resemblances in paleontological features. The conclusion is reached that the Maquoketa shales are the direct continuation of the Cincinnati series of rocks.

DAVID STARR JORDAN and CHARLES HARVEY BOLLMAN. Scientific results of the explorations by the steamer *Albatross*, No. IX. Catalogue of fishes collected at Port Castries, St. Lucia, by steamer *Albatross*, November, 1888.

*Proc. U. S. Nat. Mus.*, XII, July 17, 1890, pp. 645–652.

*Corvula sanctæ-luciæ*, new species.

DAVID STARR JORDAN and BARTON W. EVERMANN. Description of the yellow-finned trout of Twin Lakes, Colorado.

*Proc. U. S. Nat. Mus.*, XII, December 10, 1889, pp. 453, 454.

*Salmo mykiss macdonaldi*, new species. (See under Charles Harvey Bollman.)

PHILIP H. KIRSCH. Notes on a collection of fishes obtained in the Gila river at Fort Thomas, Arizona, by Lieut. W. L. Carpenter, U. S. Army.

*Proc. U. S. Nat. Mus.*, XI, September 20, 1888 (1889), pp. 555–558.

F. H. KNOWLTON. A revision of the genus *Araucarioxylon* of Kraus, with compiled descriptions and partial synonymy of the species.

*Proc. U. S. Nat. Mus.*, XII, No. 784, 1889, pp. 601–617.

S. R. KOEHLER. A stroll through the Peabody Museum, Cambridge, Massachusetts.

*The Magazine of Art* (London and New York), XII, pp. 393–396, 404–411; XIII, pp. 47–51.

A popular account of the Peabody Museum of American archæology and ethnology, Harvard University, Cambridge, Massachusetts. Written several years ago, but only now published.

S. R. KOEHLER. Schrotblätter.

*Chronik für vervielfältigende Kunst*, II, No. 9, September, 1889, pp. 65–68.

An attempt to show that the prints known as "Schrotblätter" (dotted prints, *gravures en manière criblée*) are early white-line work, executed, as a rule, with the graver upon metal.

S. R. KOEHLER. Zu einem Holzschnitt nach Primaticcio.

*Chronik für vervielfältigende Kunst*, II, No. 9, September, 1889.

Suggesting the seventeenth century and French origin for a wood cut after one of Theodor van Thulden's etchings, forming part of "Les travaux d'Ulysse, desseignez par le sieur de Saint Martin," which is attributed to an anonymous Italian wood-cutter of the sixteenth century, in Hirth and Muther's "Meister-Holzschnitte," Part V, pl. 157.

R. KOEHLER. Callot's Grosse Misères de la Guerre.

*Chronik für vervielfältigende Kunst*, II, No. 11, November, 1889, pp. 81-86.

A descriptive list of the editions and copies of the series of etchings named in the title.

R. KOEHLER. Umrisse zu Goethe's "Faust" von Retsch.

*Chronik für vervielfältigende Kunst*, III, No. 5, May, 1890, p. 38.

A short communication concerning an edition of the series named, dated 1816, and not mentioned in any of the handbooks.

R. KOEHLER. Frederick Juengling.

Privately printed, New York, 1890, without date or place of publication.

Small 4°, 12 pp.; in paper covers.

Printed in part also as an introduction to the catalogue of the auction of Juengling's works, held in New York City, March 3, 1890.

Biographical sketch of Frederick Juengling, the wood-engraver (born, Leipsic, October 18, 1846; died, New York, December 31, 1889), with some consideration of the part played by him in the development of "the new school."

ORGE F. KUNZ. Gem collection of the U. S. National Museum.

*Report of the Smithsonian Institution*. II, 1886 (1889), pp. 267-275.

WIN LINTON. Notes on Entozoa of marine fishes of New England, with descriptions of several new species.

*Annual Report of the U. S Commissioner of Fish and Fisheries*, Part xiv, 1886 (1889), pp. 453-511. 6 plates.

Studies made from the U. S. Commission of Fish and Fisheries, the material being chiefly obtained in the vicinity of Wood's Holl, Massachusetts. Sixteen species are described and figured: *Genera—Spongiobothrium, Crossobothrium, Phoreiobothrium;* species—*Dibothrium manubriforme*, *D. aluteræ*, *Spongiobothrium variabile*, *Phyllobothrium thysanocephalum*· *Orygmatobothrium angustum*, *Crossobothrium laciniatum*, *Phoreiobothrium lasium*, *Rhynchobothrium bisulcatum*, *Tænia dilatata*, and *Echinorynchus sagittifer*.

VERETT M. LOOMIS. The raven as a South Carolinian.

*The Auk*, VI, No. 3, July, 1889, pp. 277-278.

EDERIC A. LUCAS. The great auk in the U. S. National Museum.

*The Auk*, VII, No. 2, April, 1890, pp. 203-204.

(*See* under Leonhard Stejneger.)

ORGE MARX. Catalogue of the described *Araneæ* of temperate North America.

*Proc. U. S. Nat. Mus.*, XII, No. 782, 1889, pp. 497-594.

IS T. MASON. Cradles of the American aborigines.

*Report of the Smithsonian Institution*, 1887, II, pp. 161-235.

This paper is an illustrated description of the methods employed by American aborigines to hold and to transport their babes. The special motive is to enable the biological student to examine into the causes of deformity seen in most Indian skulls.

IS T. MASON. How to straighten a spear shaft.

*The American Anthropologist*, II, p. 158.

Among some South American tribes this is performed by means of weights.

IS T. MASON. Music in Honduras.

*The American Anthropologist*, II, p. 158.

The music of Central America is now of a composite character, partly native, partly African, and partly European.

IS T. MASON. The aborigines of the District of Columbia and the Lower Potomac.

*The American Anthropologist*, II, pp. 225-268.

The introduction is by Professor Mason, and the following contributions are also included:

The geologic antecedents of man in the Potomac Valley, by W J McGee.

The paleolithic period in the District of Columbia, by Thomas Wilson.

Ancient village sites and aboriginal workshops in the District of Columbia, by S. V. Proudfit.

Pottery of the Potomac tidewater region, by W. H. Holmes.

Shell mounds of the Potomac and Wicomico, by Elmer R. Reynolds.

Indian tribes of the District of Columbia, by James Mooney.

Discussion, by F. W. Putnam.

(This symposium was called forth by the requirements of the Anthropological Society of Washington, the constitution calling upon the vice-president to organize special work in their several departments.)

S T. MASON. The archæology of the Potomac tidewater region.

*Proc. U. S. Nat. Mus.* XII, March 7, 1890, pp. 367-376.

In this region are old camp-sites, workshops, soapstone quarries, shell heaps, and finds of rude forms of wrought stone, believed by some to be paleolithic, by others to be unfinished objects.

**OTIS T. MASON.** The beginnings of the carrying industry.

*The American Anthropologist*, II, pp. 21-47.

**OTIS T. MASON.** The educational aspect of the U. S. National Museum.

*Notes supplementary to the Johns Hopkins University studies in historical and political science* 1890, No. 4.

An address to students of Johns Hopkins University to call their attention to the educational method pursued in the work of the National Museum.

**OTIS T. MASON.** The human beast of burden.

*Report of the Smithsonian Institution*, II, 1887, pp. 237-295.

This paper calls attention to the beginning of the great industry which now covers the earth with beasts of burden, canals, ships, and railroads. Attention is also drawn to the fact that civilization has not relieved the weights from human backs but rather augments them.

**OTIS T. MASON.** The mutual obligation of the ethnologist and the historian.

*Papers of the American Historical Association*, IV, pp. 5-12.

The paper dwells on the proposition that the history of mankind is written in things as well as in words, and that the student of things and the student of words should [illegible] prove each other's work.

**OTIS T. MASON.** The savage's side arms.

*The American Anthropologist*, II, pp. 77, 78.

A short paper connecting ancient leaf-shaped stone implements with some now in use in California.

**OTIS T. MASON.** Woman's share in primitive culture.

*The American Anthropologist*, XI, pp. 3-13.

This paper shows that Mr. Spencer's division of civilization in time into militancy and industrialism is quite as much a sex division, the industrial pursuits of mankind originating with women in savagery.

**OTIS T. MASON.** Report on the Department of Ethnology in the U. S. National Museum, 1886.

*Report of the Smithsonian Institution*, II, 1886 (1889), pp. 87-95.

**OTIS T. MASON.** Report on the Department of Ethnology in the U. S. National Museum, 1887.

*Report of the Smithsonian Institution* (U. S. National Museum), 1887 (1889), pp. 65-75.

**SETH E. MEEK.** Notes on a collection of fishes from the Maumee Valley, Ohio.

*Proc. U. S. Nat. Mus.*, XI, Sept. 3, 1888, pp. 435-440.

**C. HART MERRIAM.** Preliminary revision of the North American pocket mice (genera *Perognathus et Cricetodipus auct.*); with descriptions of new species and subspecies, and a key to the known forms.

*North American Fauna*, No. 1, Oct. 25, 1889, pp. 1-29. Pl. I-IV.

**GEORGE P. MERRILL.** The collection of building and ornamental stones in the U. S. National Museum.

*Report of the Smithsonian Institution*, 1886 (1889), II, pp. 277-648. Pl. I-IX; 14 text figures.

Although designed as a hand-book for the collection, it has been made to cover a more extended field than indicated by its title. The aim has been to bring together in one volume as much valuable matter bearing upon the subject as the space would permit and to put it in such form as to be available for popular use. The work as above noted comprises some 370 pages; there are also nine full-page plates and fourteen figures in the text.

**GEORGE P. MERRILL.** Notes on the serpentinous rocks of Essex County, New York from Aqueduct Shaft 26, New York City, and from near Easton, Pennsylvania.

*Proc. U. S. Nat. Mus.*, XII, May 22, 1890, pp. 595-600.

**GEORGE P. MERRILL.** The cementing material of sandstone.

*Stone* (Indianapolis, Indiana), July, 1889, pp. 38, 39. 1 figure.

**GEORGE P. MERRILL.** Distribution of building stone in the United States.

*Stone* (Indianapolis, Indiana), August, 1889, p. 56.

**GEORGE P. MERRILL** Itacolumite, or flexible sandstone.

*Stone* (Indianapolis, Indiana), September 1889, pp. 72, 73.

**GEORGE P. MERRILL.** Cavities in the quartz of granite.

*Stone* (Indianapolis, Indiana), October, 1889, p. 89.

**GEORGE P. MERRILL.** The origin of diamonds.

*Stone* (Indianapolis, Indiana), November, 1889, p. 115.

EORGE P. MERRILL. Infusorial earth, or tripolite.
*Stone* (Indianapolis, Indiana), December, 1889, pp. 133-139.

EORGE P. MERRILL. Steatite, or soapstone.
*Stone* (Indianapolis, Indiana), January, 1890, pp. 148, 149.

EORGE P. MERRILL. Some processes of rock formation.
*Stone* (Indianapolis, Indiana), February, 1890, pp. 187, 188.

EORGE P. MERRILL. Some processes of rock formation.
*Stone* (Indianapolis, Indiana), March, 1890, pp. 223, 224.

EORGE P. MERRILL. Some processes of rock formation.
*Stone* (Indianapolis, Indiana), April, 1890, pp. 253, 254. 1 text-figure.

EORGE P. MERRILL. Some processes of rock formation.
*Stone* (Indianapolis, Indiana), May, 1890, pp. 17-19.

EORGE P. MERRILL. On grindstones and whetstones.
*Stone* (Indianapolis, Indiana), June, 1890, pp. 39-40.

EORGE P. MERRILL. Report on the Department of Lithology and Physical Geology in the U. S. National Museum, 1887.
*Report of the Smithsonian Institution*, II, 1886 (1889), pp. 239-244.

EORGE P. MERRILL. Report on the Department of Lithology and Physical Geology in the U. S. National Museum, 1886.
*Report of the Smithsonian Institution* (U. S. National Museum), 1887 (1889), pp. 151-153.

. OTLEY PINDAR. List of the birds of Fulton County, Kentucky.
*The Auk*, VI, No. 4, October, 1889, pp. 310-316.

HAMPDEN PORTER. Notes on the artificial deformation of children among savage and civilized peoples.
*Report of the Smithsonian Institution* (U. S. National Museum), 1887 (1889), pp. 213-235.

. WEBSTER PRENTISS. Case of poisoning by Japanese lacquer. Case of poisoning by administration of homœopathic pellets labelled "Rhus." Case of poisoning by the cashew-nut, *Anacardium Occidentale*, by D. W. Prentiss, M. D., Washington, D. C., Professor of Materia Medica and Therapeutics, Medical Department Columbian University, District of Columbia.
Pamphlet, pp. 1-17. Reprint from the "Therapeutic Gazette," July 15, 1889, Detroit, Mich.

CHARD RATHBUN. Notice of the small surface organisms taken in the tow nets, and of the contents of mackerel stomachs, by Richard Rathbun (pp. 259-267). In "Results of investigations by the schooner *Grampus* on the southern mackerel grounds in the spring of 1887," by D. E. Collins, T. H. Bean, and Richard Rathbun.
*Bull. U. S. Fish Com.*, VII, 1887 (1889), pp. 217-267.

CHARD RATHBUN. Distribution of duplicate sets of Marine Invertebrates, 1879-1886.
*Annual Report of the U. S. Commissioner of Fish and Fisheries*, pt. xiv, 1886 (1889), pp. 843-867.
These sets, 247 in number, were prepared from the duplicate specimens obtained during the dredging expeditions of the Fish Commission steamers on the Atlantic coast of the United States. The distribution was chiefly to institutions of learning in this country. The paper quoted consists mainly of tables, giving the names and origin of the species, and the names of the institutions supplied. The same information had previously been published in the Proceedings and annual reports of the National Museum, by which most of the sets were prepared and distributed.

CHARD RATHBUN. Report on the Department of Marine Invertebrates in the U. S. National Museum, 1886.
*Report of the Smithsonian Institution*, II. 1886 (1889), pp. 199-207.

CHARD RATHBUN. Report on the Department of Marine Invertebrates in the U. S. National Museum, 1887.
*Report of the Smithsonian Institution* (U. S. National Museum), 1887 (1889), pp. 125-135.

ARLES RAU. Report on the Department of Archæology in the U. S. National Museum, 1886.
*Report of the Smithsonian Institution*, II, 1886 (1889), pp. 101-112. Pl. I-IV.

ARLES RAU. Report on the Department of Archæology in the U. S. National Museum, 1887.
*Report of the Smithsonian Institution* (U. S. National Museum), 1887 (1889), pp. 83-85.

Charles W. Richmond. The yellow-throated warbler (*Dendroica domin*… Washington, D. C.

*The Auk*, VI, No. 4, October, 1889, p. 339.

Robert Ridgway. Notes on Costa Rican birds, with descriptions of seve… species and subspecies and one new genus.

*Proc. U. S. Nat. Mus.*, XI, Sept. 20, 1888 (1889), pp. 537–546.

*Beledonia*, gen. nov.; *Zeledonia coronata*, *Microcerculus orpheus*, *Picolaptes gracilis* … *canigularis*, *Picumnus flavotinctus*, *Dendrornis punctigula* and *Dendrocolaptes* … spp. nov.; *Geothlypis caninuchaic terotis* and *Xiphocolaptes emigrans costaricens*… nov.

Robert Ridgway. Natural History Survey of Illinois, | State Laboratory of Nat History, | S. A. Forbes, Director. | — | The | Ornithology | of Illinois … Part I, Descriptive Catalogue, | By Robert Ridgway, | Part II, Economic … thology, | by S. A. Forbes. | — | Volume I. | Published by authority of the … Legislature. | — | Springfield, Illinois: | H. W. Rokker, Printer and Bind… 1889.

Roy. 8vo., pp. VIII+520: pl. I–xxxii, with colored frontispiece.

[Robert Ridgway, and other members of the Committee on Classification a… menclature of the American Ornithologists' Union.]

*The Auk*, VII, No. 1, January, 1890, pp. 60–66.

(Second supplement to the American Ornithologists' Union Check List of North Americ…

Robert Ridgway. *Buteo brachyurus* and *B. fuliginosus*.

*The Auk*, VII, No. 1, January, 1890, p. 90.

Robert Ridgway. Intergradation between *Zonotrichia leucophrys* and *Z. inter*… and between the latter and *Z. gambeli*.

*The Auk*, VII, No. 1, January, 1890, p. 96.

Robert Ridgway. Letter concerning *Colymbus adamsi* and *C. glacialis*.

*The Ibis*, sixth series, II, No. 5, January, 1890, p. 129.

Robert Ridgway. A review of the genus *Xiphocolaptes* of Lesson.

*Proc. U. S. Nat. Mus.*, XII, Feb. 5, 1890, pp. 1–20.

*Xiphocolaptes argentinus*, *X. major castaneus*, subspp. nov.

Robert Ridgway. A review of the genus *Sclerurus* of Swainson.

*Proc. U. S. Nat. Mus.*, XII, Feb. 5, 1890, pp. 21–31.

*Sclerurus lawrencei*, sp. nov., *S. fuscus* (Max.), revived.

Robert Ridgway. Scientific results of explorations of the U. S. Fish Com… steamer *Albatross*. [Published by permission of Hon. Marshall Mc… U. S. Commissioner of Fisheries.] I. Birds collected on the Galapagos … in 1888.

*Proc. U. S. Nat. Mus.*, XII, February 5, 1890, pp. 101–128 (six cuts).

*Nesomimus*, gen. nov., *Nesomimus macdonaldi*, *N. personatus*, *Certhidea cinerasc*… *conirostris*, *Geospiza media*, *Cactornis brevirostris*, *C. hypoleuca*, *Camarhynchus* … *C. pauper*, *Pyrocephalus minimus*, and *Pæcilonetta galapagensis*, spp. nov.

Robert Ridgway. Scientific results of explorations by the U. S. Fish Com… Steamer *Albatross*. [Published by permission of Hon. Marshall McDona… missioner of Fisheries.] No. II. Birds collected on the Island of Sant… West Indies, Abrolhos Islands, Brazil, and at the Straits of Magellan in …

*Proc. U. S. Nat. Mus.*, XII, Feb. 5, 1890, pp. 129–139.

*Geositta longipennis* and *Upucerthia propinqua*, spp. nov.

Robert Ridgway. Harlan's hawk, a race of the red-tail and not a distinct …

*The Auk*, VII, No. 2 April, 1890, p. 205.

Robert Ridgway. Report on the Department of Birds in the U. S. National M… 1886.

*Report the of Smithsonian Institution*, II, 1886 (1889), pp. 153–162.

Robert Ridgway. Report on the Department of Birds in the U. S. National … 1887.

*Report of the Smithsonian Institution* (U. S. National Museum), 1887 (1889), pp. 95–1…

Clarence B. Riker and Frank M. Chapman. A list of birds observed at S… Brazil.

*The Auk*, VII, No. 2, April, 1890, pp. 131–137.

(See also under Frank M. Chapman.)

CHARLES V. RILEY. Locusts in Algeria.

*Insect Life*, II, No. 2, August, 1889, pp. 59–60.

Measures taken by the French Government to lessen locust ravages in Algeria.

CHARLES V. RILEY. The English Sparrow in North America.

*Bull. No.* 1, *Division of Economic Ornithology and Mammalogy, U. S. Department of Agriculture.* 8vo., pp. 405.

The author gives first a list of the insect remains found in the stomachs of 92 specimens of *Passer domesticus* submitted for examination, the insects being fully identified wherever it was possible. Then follows a succinct statement of the habits and life-history of the insects thus found, arranged according to orders, with special regard to their economic importance. A summary of the food-habits of the English sparrow as an insectivorous bird in North America, and a brief survey of other work done in the same line both in Europe and America, concludes the article.

CHARLES V. RILEY. Family *Braconidæ*. Subfamily *Microgasterinæ*. Contributions to the Parasites of North American Butterflies.

*The Butterflies of the Eastern United States and Canada*, by S. H. Scudder (Cambridge, Massachusetts), Part XII, October, 1889, pp. 1897–1911, pl. lxxxviii, figs. 11 and 12.

Also separate and part of: *The Hymenopterous Parasites of North American Butterflies*, by L. O. Howard, including a section upon Microgasters, by C. V. Riley, Cambridge, 1889.

Describes the species of *Microgasterinæ* of North America known to be parasitic on diurnal lepidoptera as follows: genus *Apanteles*, 16 species, among them as new: *A. edwardsii, cyaniridis, argynnadis, kœbelei, flavicornis, emarginatus, junoniæ, pholisoræ*; genus *Microgaster*, 1 species.

CHARLES V. RILEY. Some insect pests of the household. Bedbugs and red ants.

*Insect Life*, II, No. 4, October, 1889, pp. 104–108, figs. 16–18. (Reprinted from *Good Housekeeping*, May 25, 1889.)

Treats of the life-history of the common bedbug (*Acanthia lectularia*) and of the best remedies for this pest. Mentions the occurrence in North America of an allied species, *Conorhinus sanguisuga*. Brief review of the life-history of the red ant (*Monomorium pharaonis*) and the best remedies to be recommended for it.

CHARLES V. RILEY. Some insect pests of the household. The carpet-beetle or so-called "Buffalo moth."

*Insect Life*, II, November 5, 1889, pp. 127–130. (Reprinted from *Good Housekeeping*, April 13, 1889.)

Short review of the history of the species; description of the earlier stages and the imago; remedies.

CHARLES V. RILEY. The plum curculio. Arsenical sprays; Wier's plum immunity theory.

*Proceedings of the Twenty-second Session of the American Pomological Society* (Ocala, Florida), February 20, 1889, pp. 31–36.

Summary of various experiments with spraying mixtures as a remedy for the plum curculio and record of observations and experiments to disprove the correctness of Mr. Wier's theory.

CHARLES V. RILEY. Importation of Icerya remedies from Australia.

*Pacific Rural Press*, 38, December 21, 1889, p. 570.

A review of the history of the importation into California of Australian parasites and enemies of *Icerya purchasi*, with acknowledgments to persons who have assisted in this work.

CHARLES V. RILEY. Sur l'importation artificielle des parasites et enemies naturels des insectes nuisibles aux vegeteaux.

*Comptes Rendu des Séances du Congrès International de Zoologie*, Paris, 1889, pp. 323–326.

Contains an account of the importation of Australian parasites and enemies of *Icerya purchasi* into California, the most important of them being *Vedalia cardinalis*.

CHARLES V. RILEY. [Report of a trip to Australia to investigate the natural enemies of the Fluted Scale. By Albert Koebele.]

*U. S. Department of Agriculture, Division of Entomology, Bulletin* 21, Washington, 1890.

Contains the report of Albert Koebele, with letter of transmittal and introduction by C. V. Riley; also foot-notes by C. V. Riley relating mostly to the determination of Australian insects.

CHARLES V. RILEY. [Reports of observations and experiments in the practical work of the Divison.]

*U. S. Department of Agriculture, Division of Entomology, Bulletin* 22, Washington, 1890.

Contains the reports of the field agents of the Entomological Division, with letters of transmittal and introduction by C. V. Riley.

**Charles V. Riley.** Insecticides and means of applying them to shade and forest trees.
*Fifth Report of the U. S. Entomological Commission*, pp. 31–47.
Author's Extras. Full report not yet published. The first part gives a summary of the insecticides available for the protection of forest and shade trees from the attacks of leaf eating insects; the arsenical poisons, kerosene emulsions, and hydrocyanic acid gas are especially treated of. The second part enumerates and describes the apparatus for the application of insecticides in dry or liquid form and more especially the various nozzles and pumps for spraying, many of which are figured.

**Charles V. Riley.** Some insect pests of the household. The true clothes moths.
*Insect Life*, Nos. 7, 8, February, 1890, pp. 211–215.
Characterization of the three species of clothes moths common in the United States, and their mode of work; description of *Hyperæmus tineæ*, a parasite of *Tineola pellionella*; the question of remedies discussed.

**Charles V. Riley.** Improved methods of using hydrocyanic acid gas.
*California Fruit Grower*, VI, February 18, 1890, p. 100.
Mr. D. W. Coquillett's latest improvement in the preparation and application of hydrocyanic acid gas as a remedy for scale insects in California.

**Charles V. Riley.** [Opinion of the Gypsy Moth].
*Boston Globe*, February 17, 1890.
Publication of interview with a reporter regarding the danger resulting from the spread of the imported gypsy moth, and the best means of exterminating it.

**Charles V. Riley.** The six-spotted mite of the orange (*Tetranychus 6-maculatus* n. sp.).
*Insect Life*, II, Nos. 7, 8, February, 1890, pp. 225, 226; fig. 44.
Technical description, with figures, of *Tetranychus 6-maculatus*, a hitherto undescribed sp. injurious to the orange tree in Florida.

**Charles V. Riley.** *Platypsyllus*—egg and ultimate Larva—Dr. Horn's reclamation.
*Entomologica Americana*, VI, No. 2, February, 1890, pp. 27–30. One figure.
(Reprinted in part in *Insect Life*, II, Nos. 7, 8, February, 1890, pp. 244–246, fig. 50.)
The egg and pupa of *Platypsyllus* were not previously characterized. Describes the eggs from the oviduct and describes and figures a singular form of larva, having a strong Mallophagan appearance, giving reason for believing it to be the ultimate larva form of *Platypsyllus*. Replies to a reclamation by Dr. G. H. Horn on a question of priority.

**Charles V. Riley.** An Australian Hymenopterous Parasite of the Fluted Scale.
*Insect Life*, II, Nos. 7, 8, February, 1890, pp. 248, 249, fig. 54.
Describes *Ophelosia*, nov. gen. of *Chalcididæ*, and *Ophelosia crawfordi*, n. sp. from Adelaide, the new species being parasitic on *Icerya purchasi*.

**Charles V. Riley.** The Entomological Mission to Australia.
*Pacific Rural Press*, XXXIX, February 8, 1890, p. 146, and March 22, 1890, p. 310.
Replies to Mr. Frank McCoppin's articles relative to the history of the mission to Australia undertaken for the purpose of introducing into California parasites and enemies of *Icerya purchasi*.

**Charles V. Riley.** The Improved Gas Treatment of Scale Insects.
*Pacific Rural Press*, XXXIX, March 8, 1890, p. 261.
Records the recent improvement in the preparation and application of hydrocyanic gas as a remedy for scale insects in California.

**Charles V. Riley.** Some Insect Pests of the Household. IV. Cockroaches.
*Insect Life*, II, No. 9, March, 1890, pp. 266–269, fig. 57.
(Reprinted substantially from *Good Housekeeping*, June 8, 1889.)
Characteristics of the three species most abundant in houses, *Periplaneta americana*, *P. orientalis*, and *Phyllodromica germanica*; note on food habits and remedies.

**Charles V. Riley.** The Rose Chafer (*Macrofactylus subspinosus* Fabr.).
*Insect Life*, II, No. 10, April, 1890, pp. 295–302; fig. 61.
Past history; natural history; geographical distribution; food plants and ravages; natural checks; remedies.

**Charles V. Riley.** Microgasters Affecting Rhopalocera.
*Proceedings of the Entomological Society of Washington*, I, No. 4, 1890, p. 205.
Dwells upon the difficulties in the specific distinction in the genus Microgaster and points out certain structural characters that could be used for the purpose.

**Charles V. Riley.** Oviposition in Diptera.
*Proceedings of the Entomological Society of Washington*, I, No. 4, 1890, p. 263.
Enumerates instances where in Diptera the ovipositor is modified and fitted for puncturing.

**Charles V. Riley.** Note on the Genus Lestophonus.
*Proceedings of the Entomological Society of Washington*, I, No. 4, 1890, pp. 263, 264.
Short note on the specific distinctness of *Lestophonus Iceryæ* and *L. monophlebi*.

**Charles V. Riley.** On Dipterous Larvæ Infesting Man.

*Proceedings of the Entomological Society of Washington*, I, No. 4, 1890, p. 264.

Short account of two unpublished cases of the occurrence of *Eristalis* larvæ in the human rectum.

**Charles V. Riley.** Note on the Importation and Colonization of Parasites and other Natural Enemies of Insects Injurious to Vegetation.

*Report of the 59th Meeting*[*] *of the British Association for the Advancement of Science.* September, 1889 (London, 1890), pp. 640–642.

The author after referring to the transportation to other places of the parasites of the Plum Curculio, and to the importation into North America of the European *Microgaster glomeratus*, relates the successful importation into California and dwells on the efficacy of this coccinellid beetle in destroying the fluted scale in California.

**Charles V. Riley.** The Insect Collection of a Large Museum.

*Insect Life*, II, Nos. 11, 12, June, 1890, pp. 342–346, fig. 66.

Reprinted with slight changes from the *Annual Report of the Smithsonian Institution* for 1886 (1889), Part II, pp. 182–186.

Aims and objects of the collection. The type of systematic collection; the exhibit collection; drawers and cases used; arrangement of biologic material; method of mounting vials.

**Charles V. Riley.** Report of the Entomologist.

*First report of the Secretary of Agriculture*, 1889, pp. 331–361, plates I–IV.

Contains the following titles: Introduction, giving a general review of the work and publications of the division of Entomology, pp. 331–334; the Fluted Scale (*Icerya purchasi* Maskell), pp. 334–340; the Six-spotted Mite of the Orange (*Tetranychus 6-maculatus* Riley), pp. 340–345; the Horn Fly (*Hæmatobia serrata* Robineau-Desvoidy), pp. 345–348; the Grain Aphis (*Siphonophora avenæ* Fabr.), pp. 348–355; the Work of Field Agents, pp. 355–360.

**Charles V. Riley.** On the International Importance of Parasites and Natural Enemies of Insects Injurious to Vegetation.

*Proceedings of the American Association for the Advancement of Science*, 38th meeting,[†] August, 1889 (Salem), p. 279.

Brief abstract of a paper read before the section of biology on the international importation of *Microgaster glomeratus* and *Vedalia cardinalis*.

**Charles V. Riley.** Perfectionnements du Graphophone.

*Comptes Rendus des Seances de l'Academie des Sciences*, 17 Juin, 1889, pp. 1230–1232.

A brief review of the recent improvements in Edison's phonograph and Tainter's graphophone. The shortcomings of the latter pointed out, and the modifications and improvements invented by J. H. White, with some acoustic improvements by the author, are described.

(Also separate, pp. 2–108.)

**Charles V. Riley.** Report on the Department of Insects in the U. S. National Museum, 1886.

*Report of the Smithsonian Institution*, II, 1886 (1889), pp. 181–197, plate 1.

**Charles V. Riley.** Report on the Department of Insects in the U. S. National Museum, 1887.

*Report of the Smithsonian Institution (U. S. National Museum)*, 1887 (1889), pp. 117–123.

**Charles V. Riley and L. O. Howard.** The Phylloxera Problem Abroad as it Appears to-day.

*Insect Life*, II, No. 10, April, 1890, pp. 310, 311.

Success of defensive measures in France, more especially reconstruction of the vineyards by means of American stocks; status of the phylloxera in other countries.

**Charles V. Riley and L. O. Howard.** The Horn Fly (*Hæmatobia serrata* Robineau-Desvoidy).

*Insect Life*, II, No. 4, October, 1889, pp. 93–103, figs. 11–15.

After treating of the first appearance and spread in North America of *Hæmatobia serrata*, which appears to be introduced from Europe, the authors give a full account of the life history of this insect with descriptions of the larva and the puparium. The habits of the fly and the nature of the damage done by it are then described. The article concludes with a discussion of the best remedies and preventives.

**Charles V. Riley and L. O. Howard.** The Bot Fly of the Ox, or Ox Warble.

*Insect Life*, II, No. 5, November, 1889, pp. 156–159, figs. 26, 27.

An account of the loss caused by the ox warble in the United States and Great Britain.

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[*] Held at Newcastle-upon-Tyne.

[†] Held at Toronto.

CHARLES V. RILEY and L. O. HOWARD. **The Weeping Tree Mystery.**

*Insect Life*, II, No. 5, November, 1889, pp. 160, 161.

Brief review of an article in the Dallas (Texas) Morning News, October 9, 1889. The "wee ing" of the tree is caused by multitudes of *Proconia undata* ejecting drops of hone

CHARLES V. RILEY and L. O. HOWARD. **The so-called Mediterranean Flour Mot (*Ephestia Kuhniella Zeller*).**

*Insect Life*, II, No. 6, December, 1889, pp. 166-171, figs. 28-30.

After referring to the sudden outbreak of this pest in Canada the authors give a full dige of its history in Europe, and append a characterization of the larva and comparison of t same with allied species.

CHARLES V. RILEY and L. O. HOWARD. **The Ox Warble (*Hypoderma bovis* DeGeer**

*Insect Life*, II, No. 6, December, 1889, pp. 172-177, figs. 31-35.

From the structure of the ovipositor and from the shape of the egg the authors conclude t the egg is not inserted into the skin, but simply fastened to the skin and to the base of t hairs. The value of train oil or fish oil as a means of protection is emphasized.

CHARLES V. RILEY and L. O. HOWARD. **On some gall-making insects in New Ze and.**

*Insect Life*, II, No. 6, December, 1889, pp. 194, 195.

Correction regarding Mr. Maskell's determination of a Hymenopter supposed to produce on *Olearia furfuracea*.

CHARLES V. RILEY and L. O. HOWARD. **The imported gypsy moth (*Ocneria dispar* L**

*Insect Life*, II, Nos. 7, 8, February, 1890, pp. 208-211; figs. 36-39.

The species has been imported from Europe and appears to be thoroughly acclimated Bedford, Massachusetts. Notes on its food habits in Europe and Japan; an enumer of its numerous parasites bred in the former country.

CHARLES V. RILEY and L. O. HOWARD. **A grub supposed to have traveled in t human body.**

*Insect Life*, II, Nos. 7, 8, February, 1890, pp. 238, 239; fig. 48.

Comments on a communication from Dr. Elizabeth R. Cane, of Pennsylvania, regardi *Hypoderma* larva which traveled under the skin of a boy from the elbow to the eye 5 months.

CHARLES V. RILEY and L. O. HOWARD. **The dogwood saw-fly (*Harpiphorus var* Norton).**

*Insect Life*, II, Nos. 7, 8, February, 1889, pp. 239-243.

Various notes regarding the food habits of the larva of *Harpiphorus varianus* publi addition to Mr. J. G. Jack's article, "A Destructive Cornel Saw-fly;" variations venation of the wings; characteristics of the male saw-fly.

CHARLES V. RILEY and L. O. HOWARD. **Two parasites of the garden web-wor**

*Insect Life*, II, No. 10, April, 1890, pp. 327, 328; fig. 64.

Note on the life history and figure of *Limneria eurycreontis*; a Braconid (*Agathis* also bred from *Eurycreon rantalis*.

CHARLES V. RILEY and L. O. HOWARD. **An Icerya in Florida.**

*Insect Life*, II, No. 10, April, 1890.

Characterization of an apparently new species of *Icerya* from Key West, Florida, und MS. name of *I. rosæ*.

CHARLES V. RILEY and L. O. HOWARD. **Some of the bred parasitic Hymeno in the National Collection.**

*Insect Life*, II, Nos. 11, 12, June, 1890, pp. 348-353.

A systematic enumeration of North American parasitic Hymenoptera of the family *Bra* and their hosts, with dates and localities. The article is to be continued.

CHARLES V. RILEY and L. O. HOWARD. **Anthrax parasitic on cut worms.**

*Insect Life*, II, Nos. 11, 12, June, 1890, pp. 353, 354; fig. 67.

Several instances of North American species of Anthrax being parasitic on cut wor recorded. A review of the European literature on this subject is added.

CHARLES V. RILEY and L. O. HOWARD. **The Tulip tree leaf gall-fly (*Diplo dendri* O. S.).**

*Insect Life*, II, Nos. 11, 12, June, 1890, pp. 362, 363.

Various notes on the life history and structural characters of *Diplosis liriodendri*, in ad criticism of an article by J. G. Jack, published in "Garden and Forest."

CHARLES V. RILEY and L. O. HOWARD. **Editorials and notes.**

*Insect Life*, II, Nos. 1-12, July, 1889, to June, 1890.

(See table of contents of each number of "Insect Life.")

CHARLES V. RILEY and L. O. HOWARD. Correspondence of the Division of Entomology, U. S. Department of Agriculture.

*Insect Life*, II, Nos. 1-12, July, 1589, to June, 1890.

Selected letters from correspondents, with the replies.

(See under L. O. Howard.)

WIRT ROBINSON. Notes on some albino birds presented to the U. S. National Museum, with some remarks on albinism.

*Proc. U. S. Nat. Mus.*, XI, July 5, 1889, pp. 413-416.

JOSEPH NELSON ROSE. Preliminary notes on *Perityle.*

*The Botanical Gazette*, XV, pp. 112-119.

Described as new species *Perityle Brandegeana*, *P. Rothrockii*, *P. Greenei*, *P. Gravi*, *P. Soccorroensis;* and as a new variety *P. Emoryi*, var. *Orcuttii.*

JOSEPH NELSON ROSE. Notes on some western plants.

*The Botanical Gazette*, XV, pp. 63-66.

Described as new species *Chorizanthe Vaseyi* Parry and Rose, *Erigeron Tweedyana* Canby and Rose, *Pentstemon Tweedyi* Canby and Rose.

(See also under John Merle Coulter and George Vasey.)

OSBERT SALVIN. A list of the birds of the islands of the coast of Yucatan and of the Bay of Honduras.

*The Ibis*, Ser. I, II, No. 3, July, 1889, pp. 359-379; II, No. 1, January, 1890, pp. 84-95. (Commenced in Ser. V, VI, No. 22, April, 1888, pp. 241-265.)

OSBERT SALVIN and F. DU CANE GODMAN. [Temporary title page] | Biologia | Centrali-America na | — | aves | Vol. I | By | Osbert Salvin, M. A., F. R. R., etc., | and | Frederick Du Cane Godman, F. R. R., etc., | = 1879-1887.

E. A. SCHNEIDER. (See under F. W. Clarke.)

P. L. SCLATER. Notes on some recently described species of *Dendrocolaptidæ.*

*The Ibis*, Ser. 6, I, No. 3, July, 1889, pp. 350-354.

*Berlepschia rikeri*, Ridgw. (Proc. U. S. Nat. Mus., IX, p. 523, and X, p. 151) redescribed and figured.

P. L. SCLATER. The generic term *Calodromas.*

*The Ibis*, Ser. 6, II, No. 6, April, 1890, p. 265.

P. L. SCLATER. Catalogue | of the | *Passeriformes*, | or Perching Birds | in the | collection | of the British Museum. | — | *Oligomyodæ* or the families | *Tyrannidæ*, *Oxyrhamphidæ Pipridæ*, *Cotingidæ* | *Phytotomidæ*, *Philepittidæ*, *Pittidæ* | *Xenicidæ*, and *Eurylæmidæ*, | By | Philip Lutley Sclater. | London : | Printed by order of the trustees. 1890.

8 vo., pp. xx + 495, pl. xxvi.

This constitutes volume xiv of "Catalogue of the Birds in the British Museum."

P. L. SCLATER and WILLIAM H. HUDSON. Argentine Ornithology. | A | descriptive catalogue | of the | birds of the Argentine Republic, | by | P. L. Sclater, M. A., Ph.D., F. R. R., etc., | with notes on their habits | by | W. H. Hudson, C. M. B. S., late of Buenos Ayres | [Vignette] Burmeisters Cariama | — | Vol. II, | — | London: | R. H. Porter, 18 Princes street, Cavendish square W. | 1889.

8 vo., XXIV + 251, pl. xi-xx, colored.

W. E. D. SCOTT. A summary of observations on the birds of the gulf coast of Florida.

*The Auk*, VI, No. 4, October, 1889, pp. 318-326.

GEORGE B. SENNETT. A new species of duck from Texas.

*The Auk*, VI, No. 3, July, 1889, pp. 263-265.

*Anas maculosa.*

GEORGE B. SENNETT. A new wren from the Lower Rio Grande, Texas, with notes on Berlandier's wren of northeastern Mexico.

*The Auk*, VII, No. 1, January, 1890, pp. 57-60.

*Thryothorus ludovicianus lomitensis*, subspp. nov.

R. W. SHUFELDT: Observations upon the development of the skull in *Neotoma fuscipes;* a contribution to the morphology of the Rodentia.

*Proc. Acad. Nat. Sci., of Philadelphia*, July, 1889, pp. 14-28. Pls. i, ii, (colored). Six figures.

R. W. SHUFELDT. Osteological studies of the subfamily *Ardeinæ*, (Pt. i).

*Jour. Comp. Med. and Surg.*, (Philadelphia). Art. XV, V, X, No. 3, July, 1889, pp. 218-243. Eight figures.

Fifty reprints issued, with covers. Same title. Repaged, 1-26.

Contains concise accounts of the skeletons of many of the U. S. herons, and related birds. Material of the Museum extensively used.

R. W. SHUFELDT. The eared seals.
*Forest and Stream*, vol. XXXIII, No. 1, July 25, 1889, pp. 3–5.
(Figure of the Californian sea lion given after Elliott.)

R. W. SHUFELDT. The eared seals.
*Forest and Stream*, vol. XXXIII, No. 4, August 15, 1889, pp. 64, 65. (Illustrated by figure of Steller's sea lion).

R. W. SHUFELDT. Contributions to the comparative osteology of arctic and sub-arctic water birds. Pt. iv.
*Jour. Anat.* (London), v, XXII, July, 1889, pp. 537–558. Eight figures.
Based almost entirely upon material in collection of U. S. National Museum.

R. W. SHUFELDT. The eared seals.
*Forest and Stream*, vol. XXXIII, No. 5, August 22, 1889, p. 84.
(Illustrated by figure of fur seal.)

R. W. SHUFELDT. Note on the anserine affinities of the flamingoes.
*Science* (New York), September 27, 1889, No. 347, pp. 224, 225.

R. W. SHUFELDT. Contributions to the comparative osteology of the families of North American passeres.
*Jour. Morph.* (Boston), vol. III, No. 1, 1889, pp. 81–114. Pls. v, vi, figs. 1–26.

R. W. SHUFELDT. Notes on the anatomy of *Speotyto cunicularia hypogæa.*
*Jour. Morph.*, pp. 115–125. Pl. vii.

R. W. SHUFELDT. Osteological studies of the subfamily *Ardeinæ.*
*Jour. Comp. Med. and Surg.* (Philadelphia), x, No. 4, Art. XVIII, October, 1889, pp. 287–317. Fig 9–37.
Fifty reprints issued, with covers. Same title; repaged, 1–26.

R. W. SHUFELDT. Studies of the Macrochires, morphological and otherwise, with the view of indicating their relationships and defining their several positions in the system. (Communicated by W. K. Parker, F. R. S., F. L. S.)
*Linnæan Society's Journal* (London), Zoölogy, XX, 1889, pp. 299–394. Pl. xvii–xxiv.

R. W. SHUFELDT. True's "Contributions to the Natural History of the Cetacean. A review of the family *Delphinidæ.*" Bull. U. S. Nat. Mus., No. 36, 1889. (Review.)
*Jour. Comp. Med. and Surg.* (Philadelphia), x, No. 4, October, 1889, pp. 104–406.

R. W. SHUFELDT. Restorations of some of the more remarkable extinct mammals of the United States. No. 1. A restoration of *Tinoceros ingens.*
*The American Field* (New York and Chicago), October 26, 1889, pp. 390, 391. Four figures.

R. W. SHUFELDT. Restorations of some of the more remarkable extinct mammals of the United States. No. 2. The ancestry of the horse.
*The American Field*, No. 18, November 2, pp. 414, 415. Seven figures.

R. W. SHUFELDT. Restorations of some of the more remarkable extinct mammals of the United States. No. 3. Ancient whales and coryphodons.
*The American Field* (New York and Chicago), No. 19, November 9, 1889, p. 439. Two figures.

R. W. SHUFELDT. Restorations of some of the more remarkable extinct mammals of the United States. No. 4. Half apes and lemurs.
*The American Field* (New York and Chicago), XXXII, No. 20, November 16, 1889, pp. 463, 464. Two figures.

R. W. SHUFELDT. Restorations of some of the more remarkable extinct mammals of the United States. No. 5. The sabre-toothed tigers.
*The American Field* (New York and Chicago), No. 21, November 23, 1889, pp. 487, 488. Two figures.

R. W. SHUFELDT. Restorations of some of the more remarkable extinct mammals of the United States. No. 6. Hairy mammoths and the sea-cows.
*The American Field* (New York and Chicago), No. 22, November 30, 1889, pp. 511, 512. Two figures.

R. W. SHUFELDT. Concerning certain zoölogical considerations as referring to the classification of man.
*Pop. Sci. News* (Boston), XXIII, No. 11, November, 1889, pp. 161, 162.
Assisted by studies of the ethnological material in the U. S. National Museum.

R. W. SHUFELDT. Contributions to the comparative osteology of Arctic and Sub-arctic water birds. Pt. V.
*The Journal of Anatomy* (London), Art. 10, XXIV, n. s., IV, pt. V, 1889, pp. 89–116; Pl. vi, vii, vi
Based entirely upon material furnished by the collections of the U. S. National Museum.

R. W. SHUFELDT. On aquatic habits of certain land tortoises.

*Nature* (London), xl, No. 1044, October 31, 1889, p. 644.

R. W. SHUFELDT. Remarks upon extinct mammals of the United States.

Reprinted from *The American Field* (Chicago), xxxii, Nos. 17-22, 1889. Two hundred and fifty copies issued, being the author's edition, in paper covers, under above title, with improved figures and repagination; pp. 1-38.

The author was materially assisted by studies of material in the collections of the U. S. National Museum, especially in the use of Steller's sea-cow and skulls, and other specimens in the osteological department.

R. W. SHUFELDT. Progress in avian anatomy for the years 1888-1889.

*Jour. Comp. Med. and Vet. Arch.* (Philadelphia), xi, No. 1, January, 1890, pp. 22-26.

The work done in osteology of birds by the Department of Comparative Anatomy of the U. S. National Museum herein fully noticed.

R. W. SHUFELDT. Hints to explorers and naturalists in the field about the preparation, care, and transportation of vertebrate skeletons in the rough.

*Jour. Comp. Med. and Vet. Arch.* (Philadelphia), xi, No. 2, February, 1890, pp. 98-103.

R. W. SHUFELDT. The use to which the claws on the pollices of certain young birds are put. (Letter to editor.)

*Ibis* (London), ii, No. 5, Ser. 6, January, 1890, pp. 128, 129.

R. W. SHUFELDT. On the position of *Chamæa* in the system.

*Journal of Morphology* (Boston), iii, No. 3, December, 1889, pp. 475-502, 8 figures.

R. W. SHUFELDT. Contributions to the comparative osteology of Arctic and subarctic water-birds. Pt. vi.

*Journal of Anatomy* (London), xxiv, January, 1890, pp. 169-187. Pl. xi, xii, and numerous wood cuts in the text.

CHARLES TORREY SIMPSON. On a singular case of imitation in *Ostrea Virginica*.

*The Nautilus*, iii, No. 3, July, 1889, pp. 26, 27.

Calls attention to the reproduction on its own shell by an oyster attached to *Cerithium atratum*, of the color markings as well as the sculpture of the *Cerithium* to which it adhered.

CHARLES TORREY SIMPSON. What is a species?

*The Nautilus*, iii, No. 7, November, 1889, pp. 78-80; No. 8, December, 1889, pp. 88-90.

Discussion of the variability of molluscan forms and their systematic value.

CHARLES TORREY SIMPSON. Notes on some Indian Territory land and fresh-water shells.

*Proc. U. S. Nat. Mus.*, xi, September 3, 1888 (1889), pp. 449-454.

JOHN B. SMITH. Contribution toward a monograph of the insects of the Lepidopterous Family Noctuidæ of Temperate North America.—Revision of the species of the genus *Agrotis*.

*Bull.* 38, *U. S. Nat. Mus.*, 1889, 8vo., pp. 1-237. Pl. i-v.

JOHN B. SMITH. Notes on the species of *Lachnosterna* of Temperate North America, with descriptions of new species.

*Proc. U. S. Nat. Mus.*, xi, September 3, 1888 (1889), pp. 481-525. Pl. xlviii-lx.

SANDERSON SMITH. Lists of the dredging stations of the U. S. Fish Commission, the U. S. Coast Survey, and the British steamer *Challenger*, in North American waters, from 1867 to 1887, together with those of the principal European Government expeditions in the Atlantic and Arctic Oceans.

*Annual Report of the U. S. Commissioner of Fish and Fisheries*, Pt. xiv, 1886 (1889), pp. 873-1017. Three charts.

These lists describe the depth of water, character of the bottom, temperature, etc., at each dredging station.

ROBERT E. C. STEARNS. A mammoth land snail.

*The Nautilus*, iii, No. 3, July, 1890, pp. 29, 30.

Comments on the alleged discovery of a *Bulimus*, 19 inches long.

ROBERT E. C. STEARNS. On the distribution of *Planorbis bicarinatus*.

*West American Scientist*, September, 1889.

ROBERT E. C. STEARNS. Notes on *Physa triticea* Lea, its relations, etc.

*The Nautilus*, iii, No. 5, September, 1889, pp. 49-51.

ROBERT E. C. STEARNS. Critiques and comments.

*The Nautilus*, iii, No. 6, October, 1889, pp. 64-66.

Notes on shells and shell literature.

ROBERT E. C. STEARNS. *Stenotrema hirsuta* Say, on the West Coast.

*The Nautilus*, iii, No. 7, November, 1889, pp. 81, 82.

ROBERT E. C. STEARNS. Obituary notice of Xenos Y. Clark.
*American Naturalist*, XXIII, August, 1889, pp. 749, 750.

ROBERT E. C. STEARNS. Instances of the effects of musical sounds on anima
*American Naturalist*. XXIV, January, 1890, pp. 22–29; February, 1890, pp. 123–130; Marc pp. 236–242.

ROBERT E. C. STEARNS. Contribution to the Natural History of the *Coelentera*
*Cal. Acad. Sci.*, October, 1889, 42 pages, pl. 2.
A collection of reprints of various papers and notices relative to *Verrillia Blakei* Stearns a *Radicipes pleuro-cristatus* Stearns, bound together with an historical introduction, and title page; distributed by the author.

ROBERT E. C. STEARNS. Ethno-conchology; a study of primitive money.
*Report of the Smithsonian Institution* (U. S. National Museum), 1887 (1889), pp. 297–334, p
An account of the use of shells or shell substance as a medium of exchange or mea value.

ROBERT E. C. STEARNS. The Nishinam game of "Ha" and the Boston gam "Props."
*The Evening Star* (Washington, D. C.), May 31, 1890.
A paper read before the Anthropological Society of Washington, May 20, 1890, and par printed in the newspaper above cited.

LEONHARD STEJNEGER. Review of Japanese Birds, VIII, The Nutcracker (*Nucif caryocatactes macrorhynchos*).
*Proc. U. S. Nat. Mus.*, XI, July 5, 1888 (1889), pp. 425–432.

LEONHARD STEJNEGER. Review of Japanese Birds, IX, The Wrens.
*Proc. U. S. Nat. Mus.*, XI, September 20, 1887, pp. 547, 548.
(*Troglodytes fumigatus kurilensis*, subspp. nov.)

LEONHARD STEJNEGER. Notes on a Third Collection of Birds made in Kauai, Hawaiian Islands, by Valdemar Knudsen.
*Proc. U. S. Nat. Mus.*, XII, March 8, 1890, pp. 377–386.
(*Oreomyza wilsoni*, sp. nov.)

LEONHARD STEJNEGER. Description of a New Lizard from Lower California.
*Proc. U. S. Nat. Mus.*, XII, July, 3, 1890, pp. 643, 644.
Described as a new species, *Cnemidophorus labialis*, from Cerros Island, Lower California. Ty U. S. Nat. Mus., No. 15596.

LEONHARD STEJNEGER. Description of Two New Species of Snakes from Califor
*Proc. U. S. Nat. Mus.*, XII, February 5, 1890, pp. 95–99, with 5 figures in the text.
Described as new species *Lichanura orcutti* and *Lichanura simplex*. Types, U. S. Nat. Mu Nos. 15503, 13810. With a synopsis of the known species of the genus *Lichanura*.

LEONHARD STEJNEGER. Diagnosis of a New Species of Snake (*Lichanura orc* from San Diego County, California.
*The West American Scientist*, VI, August, 1889, p. 83. Reprinted by permission of the As Secretary from advanced sheets of the foregoing article.

LEONHARD STEJNEGER and FREDERIC A. LUCAS. Contributions to the Natu History of the Commander Islands. ——— X. Contribution to the History of Pa Cormorant.
*Proc. U. S. Nat. Mus.*, XII, February 5, 1890, pp. 83–94. Pl. 3.

Z. L. TANNER. Report on the work of the U. S. Fish Commission steamer *Albatr* for the year ending December 31, 1886. By Lieut. Comdr. Z. L. Tanner, U.S.
*Annual Report of the U. S. Commissioner of Fish and Fisheries*, pt. XIV, 1886 (1889), pp. 692. Ten plates.
Describes operations on the eastern coast of the United States, with a list of the dred stations, temperature and density observations, and a report by Thomas Lee, naturalist.

FREDERICK W. TRUE. Report on the Department of Mammals in the U. S. Nati Museum, 1886.
*Report of the Smithsonian Institution*, II, 1886 (1889), pp. 147–152.

FREDERICK W. TRUE. Report on the Department of Comparative Anatomy in th U. S. National Museum, 1886.
*Report of the Smithsonian Institution*, II, 1886 (1889), pp. 209–213.

FREDERICK W. TRUE. Report on the Department of Mammals in the U. S. Natio Museum, 1887.
*Report of the Smithsonian Institution* (U. S. National Museum), 1887 (1889), pp. 87–94.

**Frederick W. True.** Report on the Department of Comparative Anatomy in the U. S. National Museum, 1887.

*Report of the Smithsonian Institution* (U. S. National Museum), 1887 (1889), pp. 137-138.

**Frederick W. True.** Contributions to the Natural History of the Cetaceans. A Review of the family *Delphinidæ*.

*Bull.* 36, *U. S. Nat. Mus.*, 1889, 8vo., pp. 1-191. Pl. I-XLVII.

**Frederick W. True.** On the occurrence of *Echinomys semispinosus* Tomes, in Nicaragua.

*Proc. U. S. Nat. Mus.*, XI, September 3, 1888 (1889), pp. 467, 468.

**Frederick W. True.** On the mammals collected in Eastern Honduras in 1887 by Mr. Charles H. Townsend, with a description of a new subspecies of *Capromys* from Little Swan Island.

*Proc. U. S. Nat. Mus.*, XI, September 3, 1888 (1889), pp. 469-472.

**Lucien M. Turner.** The single-headed drum of the Naskopie (Nagnagnot) Indians, Ungava District, Hudson Bay Territory.

*Proc. U. S. Nat. Mus.*, XI, September 3, 1888 (1889), pp. 433, 434.

**George Vasey.** List of the plants collected in Alaska in 1888, No. VI.

*Proc. U. S. Nat. Mus.*, XII, No. 772, 1889, pp. 217-218.

**George Vasey.** A new grass.

*The Botanical Gazette*, XV, pp. 106-110.

Described as a new genus and species *Rhachidospernum Mexicanum* (with plate).

**George Vasey.** New or little known plants: *Uniola Palmeri*.

*Garden and Forest*, II, pp. 401-402.

Described as new *Uniola Palmeri* (with figures).

**George Vasey** and **Joseph Nelson Rose.** List of plants collected by Dr. Edward Palmer in 1889 at Lagoon Head, Cedros Island, San Benito Island, Guadeloupe Island, head of the Gulf of California.

*Contributions from the U. S. National Herbarium*, I, No. 1, pp. 9-28.

Described by Mr. Rose as new species: *Sisymbrium Brandegeana*, *Allium Californicum*, *Encelia Cedrosensis*, *Phacelia* (*Eutoca*) *Cedrosensis*, *Nicotiana Greeneana*, *Eschscholzia*, *Palmeri*, *Sphæralcea Palmeri*, *Hemizonia* (*Hartmannia*) *Palmeri*, *H.* (*H*) *Greeneana*, and by Dr. C. F. Millspaugh, *Euphorbia Pondii*.

Also published in the *Proc. U. S. Nat. Mus.*, XI, September 3, 1888 (1889), pp. 527-536.

**Charles D. Walcott.** Description of new genera and species of fossils from the Middle Cambrian.

*Proc. U. S. Nat. Mus.*, XI, July 5, 1888 (1889), pp. 441-446.

**Charles D. Walcott.** A simple method of measuring the thickness of inclined strata by means of a clinometer compass and a rod.

*Proc. U. S. Nat. Mus.*, XI, 1888 (1889), September 3, pp. 447-448.

This is a description of a method of measuring the thickness of inclined strata by means of a clinometer and a rod. One cut.

**Charles D. Walcott.** A fossil Lingula preserving the cast of the Peduncle.

*Proc. U. S. Nat. Mus.*, XI, 1888 (1889), September 3, p. 480.

This is a description and illustration of a specimen of *Lingula æqualis* Hall, showing the peduncle extending out from the ventral valve.

**Charles D. Walcott.** Descriptive notes of new genera and species from the Lower Cambrian or Olenellus zone of North America.

*Proc. U. S. Nat. Mus.*, XII, 1889 (1890), February 5, pp. 33-46.

There is included in this paper a description of the new genera *Avalonia*, *Helenia*, and *Coleoloides*, and a number of new species with remarks upon some that have been previously described.

**Charles D. Walcott.** Description of a new genus and species of inarticulate brachiopod from the Trenton limestone.

*Proc. U. S. Nat. Mus.*, XII, 1889 (1890), December 10, pp. 365, 366.

A description of the genus *Conotreta*, a small inarticulate brachiopod allied to *Acrotreta*.

**Charles D. Walcott.** A review of Dr. R. W. Ells's second report on the geology of a portion of the Province of Quebec, with additional notes on the "Quebec Group."

*Amer. Jour. Sci.*, ser. 3, XXXIX, 1890, pp. 101-115.

In the additions to the review of Dr. Ells's report are descriptions and observations made by the writer. He concludes, in agreement with Dr. Ells, that the Quebec group should be dropped from geologic nomenclature.

**CHARLES D. WALCOTT.** A review of the report of the State geologist of New York for the year 1888.

*Amer. Jour. Sci.*, ser. 3, XXXIX, 1890, pp. 155, 156.

A short review of the contents of the report with special reference to the presence of th Hercynian fauna or its representative in America, and the classification of the Upper Silurian and Devonian rocks as influenced by the presence of this fauna.

**CHARLES D. WALCOTT.** Study of a line of displacement in the Grand Cañon of th Colorado, in northern Arizona.

*Bull. Geol. Soc. America*, I, 1889, pp. 49–64. Twelve figures.

A description of an ancient pre-Cambrian fault, upon which a movement took place in lat Tertiary times, reversing the movement of pre-Cambrian time. It is accompanied descriptive details and numerous illustrations.

**CHARLES D. WALCOTT.** The value of the term "Hudson River Group" in geolog. nomenclature.

*Bull. Geol. Soc. America*, I, 1890, pp. 335–355.

A brief historical notice and a description of the rocks referred to the Hudson River gr by the geologists in New York, Ohio, and the Mississippi Valley. The conclusion rea is that the term "Hudson" has a definite value in geologic nomenclature, and should used in a generic sense as expressed in the following tabulation:

| Terrane. | Formations. |
|---|---|
| Hudson | Hudson River shales and grits. Utica shale. |
| | Frankfort shale. |
| | Lorraine shale and sandstone. |
| | Salmon River sandstone and shale. |
| | Cincinnati shale and limestone. |
| | Nashville shale. |
| | Maquoketa shale. |

**CHARLES D. WALCOTT.** Report on the Department of Invertebrate Fossils (Paleozo in the U. S. National Museum, 1886.

*Report of the Smithsonian Institution*, II, 1886 (1889), pp. 215–227.

**CHARLES D. WALCOTT.** Report on the Department of Invertebrate Fossils (Paleozo in the U. S. National Museum, 1887.

*Report of the Smithsonian Institution* (U. S. National Museum), 1887 (1889), pp. 139–141.

**LESTER F. WARD.*** Why is water considered ghost-proof?

*Science*, V, January 2, 1885, p. 2.

The suggestion is made that the wide-spread belief among savages that "water is impass to spirits" may be due to the obstacles it presents to dogs in pursuing their prey, tra their masters, etc.

**LESTER F. WARD.** A glance at the history of our knowledge of fossil plants.

*Science*, V, January 30, 1885, pp. 93–95.

Brief review of the progress of Paleobotany from the earliest times.

**LESTER F. WARD.** Fontaine's older Mesozoic flora of Virginia.

*Science*, V, April 3, 1885, pp. 280, 281.

Review of that work.

**LESTER F. WARD.** Lesquereux's Cretaceous and Tertiary flora.

*Science*, V, April 24, 1885, pp. 348, 349.

Review of that work.

**LESTER F. WARD.** Premature appearance of the periodical cicada.

*Science*, V, June 12, 1885. p. 476.

Letter to *Science* recording the hearing of the note of the periodical cicada on Octob 1884, with an attempt to account for the phenomenon.

**LESTER F. WARD.** The ginkgo-tree.

*Science*, V, June 19, 1885, pp. 495–497.

An account of the discovery of the flowering for the first time of two ginkgo-trees in U. S. Botanic Garden at Washington, followed by remarks on the character and distri of this tree and its paleontological history. Two of the illustrations are of spe collected by the writer.

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* Mr. Ward's Bibliography from January, 1885, to June, 1886, was omitted from the reports of National Museum. It is supplied here in connection with that for the year ending June 30, 18

LESTER F. WARD. Evolution in the vegetable kingdom.

*American Naturalist*, XIX, July, August, 1885, pp. 537–644; 745–753.

This article discusses the progress that has been made in our knowledge of the laws of development in the vegetable kingdom, considering the subject from the three-fold point of view: its chronological, geological, and botanical history. The second and third parts of the paper are the same as read at the American Association for the Advancement of Science at Philadelphia, September 8, 1884. The first part is an expansion of the corresponding portion of that paper.

LESTER F. WARD. Historical view of the fossil flora of the globe. Geological view of the fossil flora of the globe. Botanical view of the fossil flora of the globe.

*Proc. Amer. Assn. Adv. Sci.*, XXXIII, September, 1884, pp. 493–497.

Abstract of papers read before section F, September 8, 1884.

LESTER F. WARD. A convenient system of river nomenclature.

*Science*, VI, October 9, 1885, pp. 321–322.

Suggests the giving of monosyllabic names to the tributaries of rivers and of combining these to form the names of the streams which the tributaries unite to form, after the analogy of the Mattapony in Virginia.

LESTER F. WARD. Moral and material progress contrasted.

*Transactions of the Anthropological Society*, III, 1884–1885, pp. 121–130 (136).

An argument for conscious activity on the part of society in seeking its own welfare, by showing that the moral condition of mankind has not kept pace with material progress in which such conscious activity has been exercised by individuals.

LESTER F. WARD. An example in political science.

*The Daily Telegraph* (New York), November 3, 1885, p. 4.

A scientific treatment of the tariff question.

LESTER F. WARD. Mind as a social factor (Abstract).

*Transactions of the Anthropological Society of Washington*, III, 1885, pp. 31–32.

The paper was published in full in Mind (London), IX, October, 1884, pp. 563–573, and is mentioned above under that date.

LESTER F. WARD. Remarks on Mr. H. H. Bates's paper on "Discontinuities in Nature's Methods."

*Transactions of the Anthropological Society of Washington*, III, 1885, pp. 53–54.

Welcomes the introduction of the physical term *discontinuities* into biology in the sense given to it by Mr. Bates, *i. e.*, not implying actual breaks in the series, and offers additional examples.

LESTER F. WARD. Remarks on Prof. J. M. Gregory's paper on the "Elements of Modern Civilization."

*Transactions of the Anthropological Society of Washington*, III, 1885, pp. 63–64.

Approves the classification of social activities proposed by Professor Gregory, and shows that it is substantially the same as that elaborated by the speaker and published three years before (Science, October 23, 1880, pp. 210, 211), and then in press as part of Chapter VII of his forthcoming work on dynamic sociology.

LESTER F. WARD. A National University.

*Science*, VI, December 18, 1885, p. 539.

Letter approving Secretary Lamar's recommendation of the establishment of such an institution by the Government at Washington.

LESTER F. WARD. Administrative Report of the Chief of the Division of Paleobotany, U. S. Geological Survey, for the year ending June 30, 1884.

*Report of the U. S. Geological Survey*, 1883–1884, pp. 55–59.

LESTER F. WARD. Sketch of Paleobotany.

*Report of the U. S. Geological Survey*, 1883–1884, pp. 357–452. Pl. LVI–LVIII.

Gives an historical review of paleobotanical discovery with profuse bibliographical references, a sketch of the history of paleobotany down to the year 1850, an account of the present state of the science, remarks on the nomenclature of fossil plants, a review of the progress toward a natural method of botanical classification, especially as indicated by paleophytology, and a geognostico-botanical view of the plant life of the globe, past and present, illustrated by a tabular exhibit and three diagrams, one of which is colored.

LESTER F. WARD. Notes on the flora of Eastern Virginia.

*Botanical Gazette*, XI, February, 1886, pp. 32–38.

The more striking changes that occur in the flora on traveling southward from Washington, D. C., to Weldon, N. C., are pointed out and commented upon.

LESTER F. WARD. Moral and material progress.

*The Capital* (Washington), March 28, 1886, p. 4.

Abstract of the paper above noticed on moral and material progress contrasted.

**Lester F. Ward.** On the determination of fossil dicotyledonous leaves.

*Amer. Jour. Sci.*, XXI, May, 1886, pp. 370–375.

Contains a brief review of the progress made in this line of research preparatory to the nomenclature proposed by Nathorst in a recent paper which analyzed and criticised. (Papers published during 1889–1890).

**Lester F. Ward.** The sociological position of protection and free trade.

*The American Anthropologist* (Washington), II, October, 1889, pp. 289–299.

Argues that protection can be theoretically defended as resting upon the progressive principle of invention, free trade representing the absence of any social effort to improve the commercial and industrial condition.

**Lester F. Ward.** Fortuitous variation. Being an abstract of a paper thus entitled, read before the Biological Society of Washington, December 15, 1888.

*Nature* (London), XL, July 25, 1889, p. 310.

The full title of the paper, as orally presented with exhibition of specimens and comments thereon, was "Fortuitous Variation as illustrated by the Genus *Eupatorium*." The variations in the leaves of the different species of this genus were held to be such as could not all be produced by natural selection, obviously not being specially advantageous to the plant. It was argued that they were fortuitous in the proper scientific sense of that word: *i. e.*, they were the result of the universal pressure of organic life in all directions and represented those directions in which such pressure had been successful, the lines of least resistance.

**Lester F. Ward.** Causes of belief in immortality.

*The Forum* (New York), VIII, September, 1889, pp. 98–107.

The great prevalence of this belief is claimed to be the result of natural causes operating upon primitive man, resulting in a universal notion of spirit, and the chief of these natural causes are enumerated.

**Lester F. Ward.** Jurassic plants from Kaga, Higa, and Echizen (Japan). By Matajiro Yokoyama.

*American Journal of Science*, XXXVIII, Ser. 3, November, 1889, p. 414.

Brief notice of a paper by the above title in the Journal of the College of Science, Imperial University of Japan, III, Pt. I, Tokio, Japan, 1889.

**Lester F. Ward.** The Tertiary flora of Australia. By Dr. Constantin, Baron von Ettingshausen. English translation edited by R. Etheridge, jr., Sydney, 1888.

*American Journal of Science*, XXXVIII, Ser. 3, December, 1889, p. 493.

Brief notice of a paper with the above title, referring to a fuller analysis of the original memoirs to appear in the Eighth Annual Report of the U. S. Geological Survey (pp. 812–814).

**Lester F. Ward.** Contribuzioni alla flora fossile dei terreni terziarii della liguria. By S. Squinabol. I. Fucoidi ed Elmintoidee, Roma, 1888; II. Caracee-Felci. Genova, 1889.

*American Journal of Science*, XXXIX, Ser. 3, January, 1890, pp. 72, 73.

Brief notice of papers with the above titles published by the Italian Geological Society and University of Genoa.

**Lester F. Ward.** Administrative Report to the Director of the U. S. Geological Survey for the year ending June 30, 1887.

*Eighth Annual Report of the U. S. Geological Survey*, 1886–1887, Pt. I, 1889, pp. 184–189. Issued February, 1890.

**Lester F. Ward.** The geographical distribution of plants.

*Eighth Annual Report of the U. S. Geological Survey*, 1886–1887, Pt. II, 1889, pp. 663–960, Pl. LXI, issued February, 1890.

An extended and detailed enumeration of the localities at which fossil plants have been found, the works mentioning them, and the age of the deposits in which they occur; arranged primarily in a geographical order beginning with England and ending with the United States, with a map of the United States showing the localities and formations.

**Lester F. Ward.** The course of biologic evolution. Annual Address of the President of the Biological Society of Washington, delivered January 25, 1890.

*Proc. Biol. Soc. of Washington*, V, 1890, pp. 23–55; Pamphlet, pp. 1–33.

The fundamental and distinct modes or lines of development are recognized, the normal and the extra-normal. In both, evolution takes place chiefly through the law of the extinction of trunk lines of descent, coupled with that of the persistence of unspecialized types. Normal development is illustrated in the vegetable kingdom, the principal steps being the origin of exogeny, phenogamy, gymnospermy, angiospermy, exogenous angiospermy, and

LESTER F. WARD—Continued.

the development of floral envelops, apetaly, polypetaly, gamopetaly. Extra-normal development is illustrated by fortuitous variation, in general by the origin of showy and fragrant flowers, and of bright-colored and sweet-flavored fruits. The abnormalities of sex as produced by both female and male selection are explained. Finally it is shown that all extra-normal development is the result of the origin and growth of the psychic element.

LESTER F. WARD. On fossil plants collected by Mr. R. A. McConnell, on Mackenzie River, and by Mr. T. C. Weston, on Bow River. By Sir J. W. Dawson.

*Amer. Jour. Sci.*, XXXIX, Ser. 3, May, 1890, p. 406.

Notice of a paper with the above title.

LESTER F. WARD. Report on the Department of Fossil Plants in the U. S. National Museum, 1886.

*Report of the Smithsonian Institution*, II, 1886 (1889), p. 231.

LESTER F. WARD. Report on the Department of Recent Plants in the U. S. National Museum, 1886.

*Report of the Smithsonian Institution*, II 1886 (1889), pp. 233–235.

LESTER F. WARD. Report on the department of Fossil Plants in the U. S. National Museum, 1887.

*Report of the Smithsonian Institution* (U. S. National Museum), 1887 (1889), pp. 145, 146.

LESTER F. WARD. Report on the department of Recent Plants in the U. S. National Museum, 1887.

*Report of the Smithsonian Institution* (U. S. National Museum, 1887 (1889), pp. 145, 146.

LESTER F. WARD. Remarks on Dr. Newberry's paper on the Laramie Group, at the Geological Society of America in New York, December 26, 1889.

*Bull. Geol. Soc. Amer.*, I, 1890, pp. 529–532.

These remarks relate chiefly to the position which Fort Union beds occupy relatively to the original Laramie deposits of Colorado and Wyoming.

LESTER F. WARD. Remarks on Mr. David White's paper on Cretaceous plants from Marthas Vineyard, at the Geological Society of America in New York, December 28, 1889.

*Bull. Geol. Soc. Amer.*, I, 1890, pp. 555–556.

Pointing out especially the importance of Mr. White's discoveries to geology in settling beyond further dispute the age of a certain portion at least of the Gay Head section, which has been the subject of geological investigation for a century, and was still enshrouded with doubt.

LESTER F. WARD. Genius and woman's intuition.

*The Forum* (New York), IX, June, 1890, pp. 401–408.

This article is a reply to one by Grant Allen on woman's intuition, in the preceding number of the Forum. It aims to give a scientific explanation of the origin and nature of the well-known faculty by which most women are able to arrive instantaneously and correctly at the decision of certain questions of practical life, and point out what these questions are and their limitations, thus denying the implication in the article reviewed that the faculty is general or occult. It refutes the claim of Mr. Allen that there is any analogy between this power and that of true genius, and shows that the two faculties are distinctly antagonistic, the former being essentially practical, while the latter is essentially ideal. Mr. Allen's theory that men of genius are the sons of women in whom the intuitive faculty is highly developed is shown to be erroneous, the popular view being that they are the sons of women of intellectual superiority. The conclusion is drawn that the chief desideratum is the intellectual development of women.

LESTER F. WARD. The Potomac or younger mesozoic flora; by William Fontaine).

*Amer. Jour. Sci.*, XXXIX, Ser. 3, June, 1890, p. 520.

Notice of the work of the above title being Monograph No. XV of the U. S. Geological Survey Washington, 1889.

J. ELFRETH WATKINS. The air ship (its influence on travel should it be perfected).

*The Epoch*, VI, No. 132, Aug. 16, 1889, p. 447.

Containing an approximate cost of the construction and operation of a theoretical air ship.

J. ELFRETH WATKINS. Report on the Section of Steam Transportation in the U. S. National Museum, 1886.

*Report of the Smithsonian Institution*, II, 1886 (1889), pp. 119–141.

J. ELFRETH WATKINS. Report on the Section of Steam Transportation in the U. S. National Museum, 1887.

*Report of the Smithsonian Institution* (U. S. National Museum), 1887 (1889), pp. 79–81.

**Charles A. White.** The Lower Cretaceous of the Southwest and its relations; underlying and overlying formations.

*Amer. Jour. Sci.*, XXXVIII, December, 1889, pp. 440-445.

**Charles A. White.** The North American Mesozoic. Address as Vice-President of Section E of the American Association for the Advancement of Science, at Toronto, August, 1889.

*Proc. Amer. Assn. Adv. Sci.*, XXXVIII, pp. 1-24.

**Charles A. White.** Report on the Department of Invertebrate Fossils (Mesozoic) in the U. S. National Museum, 1886.

*Report of the Smithsonian Institution*, II, 1886 (1889), pp. 229-230.

**Charles A. White.** Report on the Department of Invertebrate Fossils (Mesozoic) in the U. S. National Museum, 1887.

*Report of the Smithsonian Institution* (U. S. National Museum), 1887 (1889), p. 143.

**Henry S. Williams.** The Cuboides Zone and its fauna; a discussion of methods of correlation.

*Bull. Geol. Soc. Amer.*, I, 1890, pp. 481-500. Pl. 11-13.

A description of the Cuboides Zone of the New York section and correlation of it with Cuboides Zone of the Devonian system of Europe. The discussion of the methods of correlation includes the application of paleontologic and stratigraphic evidence as a basis of correlation.

**Scott Wilson.** On some of the birds of the Sandwich Islands.

*The Ibis*, Sixth Series, II, No. 6, April, 1890, pp. 170-196. Pl. i (colored).

*Hemignathus stejnegeri*, pl. vi, fig. 2, (*H. obscurus* Stejn. Proc. U. S. Nat. Mus, 1887, p. 83)

**Thomas Wilson.** [Anthropological Notes in the "American Naturalist."]

Mound Explorations by W. K. Moorehead in Ross County, Ohio, XXIII, No. 273, September, 1889, pp. 834-839.

Congresses, National and International, held in Paris during the French Exposition of 1889, XXIV, No. 278, February, 1890, pp. 197-200.

Prehistoric Occupation in Cambodia—shell-heaps in Asia—Polished stone implements in the National Museum, XXIV, No. 279, March, 1890, pp. 286-289.

Fort Ancient, Ohio (illustrated), XXIV, No. 280, April, 1890, pp. 383, 384.

Classification of arrow and spear heads or knives in the National Museum—Archæologic discoveries—Archæologic or Archæological?—Human and animal remains, XXIV, No. [illegible] May, 1890, pp. 589-594.

**Thomas Wilson.** The paleolithic period in the District of Columbia.

*Proc. U. S. Nat. Mus.*, XII, No. 777, Mar. 7, 1890, pp. 371-376. Pl. xvii-xxi.

Also printed in the "American Anthropologist," II, July, 1889, pp. 235-241.

**Thomas Wilson.** The civilization of the Indians of North America.

*Association Française pour l'Avancement des Science* (Paris), August, 1889.

**Thomas Wilson.** The Falls of Niagara, its value as a chronometer of antiquity.

*Association Française pour l'Avancement des Sciences* (Paris), August, 1889.

**Thomas Wilson.** Prehistoric implements and objects in hard or semi-precious stone in America.

*Association Française pour l'Avancement des Sciences* (Paris), August, 1889.

**Thomas Wilson.** The Smithsonian Institution and its Anthropologic Work.

*Journal of Anthropological Institute of Great Britain and Ireland*, XIX, No. 4, May, [illegible] 509-515.

**H. C. Yarrow.** Report on the Department of Reptiles and Batrachians in the U. S. National Museum, 1886.

*Report of the Smithsonian Institution*, II, 1886 (1889), pp. 165, 166.

**H. C. Yarrow.** Report on the Department of Reptiles and Batrachians in the U. S. National Museum, 1887.

*Report of the Smithsonian Institution* (U. S. National Museum), 1887 (1889), pp. 103, 104.

**W. S. Yeates.** Pseudomorphs of native copper after azurite from Grant County, New Mexico.

*Amer. Jour. Sci.*, November, 1889.

**W. S. Yeates.** New localities for phenakite.

*Amer. Jour. Sci.*, April 1890.

# SECTION V.

## LIST OF ACCESSIONS TO THE U. S. NATIONAL MUSEUM DURING THE YEAR ENDING JUNE 30, 1890.

# LIST OF ACCESSIONS.

Abbott, W. H. Models of boats and vessels collected under the direction of the U. S. Fish Commission for the Department of Naval Architecture, and received from the gentlemen below mentioned:

Hon. V. L. Coffin.
J. Kennedy.
William Welch.
G. R. Campbell & Co.
James B. Crawford.
D. A. Simpson.
Hamen Cousins.
C. L. Young.
Isaac M. Grant.
Abraham Lord.
Moses B. Day.
Robert Doritz.
Joshua Watson.
Dudley A. Carlton.
F. L. Tyler.

A complete list of the models, with names of donors, is here given:

Campbell, G. R. & Co., Cherryfield, Maine. Builder's skeleton model of brig *Telula*, built at Cherryfield, Maine, by Asa Dyer.

Carlton, D. A., Sedgwick, Maine. Model of figure-head of brig *Burmah*, built at North Castine, Maine, in 1843.

Coffin, Hon. V. L., Harrington, Maine. Builder's model of half-brig *Antelope*, built at Harrington, Maine, in 1866, double decks; builder's model of brig *Eva N. Johnson*, built at Harrington, Maine, in 1867, by Ramsdell, Rumble & Coffin; builder's model of three-masted schooner *James M. Riley*, built at Harrington, Maine, in 1872, by Ramsdell, Rumble & Coffin.

Cousins, Hamen, Lamoine, Maine. Builder's model of two-masted schooner *Waukeag*, built at Trenton (now Lamoine), Maine, in 1855, by Hamen Cousins; builder's model of two-masted schooner *Mountain Laurel*, built at Trenton (now Lamoine), Maine, in 1866, by Hamen Cousins.

Crawford, J. B., Castine, Maine. Builder's model of ship *Atticus*, built at Castine, Maine, in 1818, by James Crawford; builder's model of ship *Lucas* (full rigged), built at Castine, Maine, in 1827, by James Crawford.

Day, M. B., Sedgwick, Maine. Builder's model of schooner *J. W. Hale*, built at Brooklin, Maine, in 1855, by M. B. Day. (Single deck.)

Doritz, Robert, Sargentville, Maine. Builder's model of schooner *E. Closson*, built at Sedgwick, Maine, in 1860, by R. Doritz; builder's model of schooner *Lucy*, modeled and built by R. Doritz, at Sargentville (in Sedgwick Township), Maine, 1852.

Grant, Isaac M., Ellsworth, Maine. Builder's model of schooner *D. S. Lawrence*, built at Ellsworth, Maine, by Isaac M. Grant, in 1871; builder's model of schooner *William H. Archer*, built at Ellsworth, Maine, by Isaac M. Grant, in 1871; builder's model of bark *Julia*, built at Ellsworth, Maine, by Isaac M. Grant, in 1877.

Kennedy, J., Lubec, Maine. Builder's model of schooner *Aaron*, built at Lubec, Maine, about 1854, by J. Kennedy.

Lord, Abraham, Ellsworth, Maine. Builder's model of hermaphrodite brig *Fredonia*, built at Ellsworth, Maine, in 1854, by N. H. Hall. (Single deck.)

Simpson, D. A., Sullivan, Maine. Builder's model of two-masted hermaphrodite brig *Amethyst*, built at Sullivan, Maine, in 1840, by Richard Simpson; builder's model of two-masted schooner *North Star*, built at Sullivan, Maine, by Richard Simpson.

Tyler, F. L., Frankfort, Maine. Builder's skeleton model of topsail schooner *Ruth Thomas*, built at Frankfort, Maine, in 1845, by Thomas & Whitman.

Watson, J., Sedgwick, Maine. Builder's model of schooner *Watchman*, modeled and built by Joshua Watson at Seaville, Tinker's Island, Maine, in 1847; builder's model of brig *Watson*, modeled and built by J. Watson at Sedgwick, Maine, in 1848; builder's model of brig *Abby Watson*, modeled and built as above in 1852.

Welch, William, West Pembroke, Maine. Builder's model of two-masted schooner *Ada S. Allen*, built at Dennysville, Maine, in 1867, by F. W. Allen & Son.

Young, C L., Lamoine, Maine. Builder's model of two-masted brig *Icarias*, built at Trenton (now Lamoine), Maine, in 1852, by Hamen Cousins.

ABBOTT, Dr. W. L. (Zanzibar, East Africa). A large and valuable collection, consisting of skins and skulls of large and small mammals, including rhinoceros heads, buffalo heads, wart-hog, Pigmy Antelope (*Neotragus*), Tree Coney (red) (*Dendrohyra*), (*Ichneumons crossarchus*) (new to the collection), from the vicinity of Mount Kilima-njaro. One hundred and ten ethnological objects, consisting of swords, daggers, knives, shields, arrows, clubs, wooden dishes, bowls, spoons, clothing, war-cap, baskets, beaded belts, neck rings, armlets and anklets, ear ornaments, snuff horns, medicine-girdle, etc. Collection of insects, birds' skins, specimen of *Chromis niloticus*, shells, two specimens of *Achatina reticulata* Peiffer from Zanzibar, head of *Cobra naja* sp., alcoholic specimens of reptiles, skin of crocodile, and eggs of ostrich. 23158. (For description of Pigmy Antelope and Tree Coney see Proceedings of the National Museum, vol. XII, 1890, pp. 227–229.)

ABERT, CHARLES (Norbeck, Maryland). Original bust of Benjamin Franklin, executed by *Corrachi* in Italian marble. 23089.

ADAMS, C. F. (Champaign, Illinois). Group of *Nasalis larvatus* from Borneo (2275[illegible]); collection of mammal skins and bones (22331); twenty specimens from near the town of Sandakan; seventeen specimens from Kiniabatangan River; fourteen specimens from Suanlamba River, and twelve specimens from Sapagaya River, British North Borneo.

ADAMS, FRED. J. (Grand Rapids, Michigan). Ribbon badge of the Michigan Press Association, session of 1889, held at Grand Rapids, July 9 et seq. 22217.

ADAMS, L. J. (Vineland, New Jersey). Arrow-points and a fragment of pottery. 22673.

ADAMS, S. and J. (Bangor, Maine). Specimen of biotite granite from near Wilson Stream, head of Sebec Lake, Maine. 23339.

ADAMS, W. H. (Chase, Illinois), (through Prof. J. F. James, U. S. Geological Survey). Specimens of *Zaprentis dalii*, M. and H., *Polyphemopsis* sp.? and *Macrochilina medialis*, M. and H., from the Coal Measures of Illinois. 22570.

ADAMS, WILLIAM W. (Mapleton, New York). Specimens of copper spear-heads from Michigan and New York (purchase). 22229.

AGRICULTURE, DEPARTMENT OF:

(Through Prof. C. V. Riley, Entomologist.) Collection of insects gathered in Australia and New Zealand, by Mr. A. Koebele, agent of the Department, [illegible] specimens, representing 250 species of *Coleoptera*; 128 specimens, representing 52 species of *Hemiptera*, and 200 specimens representing 40 specimens of *Orthoptera* (22747); collection of insects belonging to the late Dr. Asa Fitch. (2311[illegible]

(Through Dr. B. E. Fernow.) Map showing percentage of forest areas, exhibited at the Paris Exposition. 22796.

(Through Dr. C. H. Merriam.) Collection of reptiles from Arizona (23030); two living Canada Porcupines (*Erethrizon dorsatus*) from northern Minnesota (23073); Horned Toad (*Phrynosoma brevirostre*), with sample of earth upon which it was living, from Bridger's Pass, Wyoming (23259); two nests and eggs of *Spizella breweri*, eggs of *Sturnella magna neglecta* and *Falco richardsoni* (23305); collection of batrachians from San Francisco Mountain, Arizona (23333).

**Alaska Commercial Company** (San Francisco, California). Bidarkas and paddles, from the following localities: Kusilak, mouth of the Yukon River; St. Michael's; Unalaklik, 60 miles north of St. Michael's; Cape Vancouver; Nunwak Island, 250 miles south of St. Michael's, and Unalaska. 22485. (See also under Capt. M. A. Healy.)

**Allen, Dr. H. N.** (Secretary of the Corean Legation, Washington, District of Columbia). Collection of 118 ethnological objects, many of which were given to Dr. Allen by the King of Corea (deposit) (22405); specimen of gold ore from the province of Pyong an do Wen San Mines (gift) (22412).

**Allen, Ira B.** (Fair Haven, Vermont). Specimen of mineral from the mica mines at Amelia Court House, Virginia (collected by Mr. W. S. Yeates of the National Museum) (22199); specimens of Amazonstone from same locality (23257).

**Allen, J. D.** (Mandan, South Dakota). Three specimens of *Mazama montana*. 23081.

**American Bank Note Company** (through James Macdonough, president, (New York City). Proof from a bank note die. 23277.

**American Museum of Natural History** (New York City). Skin of bull Moose from Maine; skin of African lion; two skins of Prong-horned Antelope from Montana, and mold of lion in flesh (exchange) (22188); specimen of Agassiz's Gopher (*Xerobates agassizi*) from Tucson, Arizona (2216); life-size bust in plaster of the chimpanzee *Crowley* of the Central Park Menagerie (22280); 213 specimens, representing 16 species of birds' skins from Arizona (22625).

**Anthony, A. W.** (San Diego, California). Three eggs (one set) of *Pelecanus californicus*. 22540.

**Appleton, J. W. M.** (Salt Sulphur Springs, West Virginia). Specimen of *Gordius aquaticus*. 23013.

**Appleton, Nathan** (Boston, Massachusetts), (through G. L. Gillespie, lieutenant-colonel of Engineers, U. S. Army). Mahogany gun-carriage from the citadel of Santo Domingo, probably made by the Spaniards during the early days of their possession of the island (23201); photograph of the council of *Sitting Bull* and other Indians, at Standing Rock, and photograph of the monument to General Custer (23206).

**Arizona Sandstone Company** (Los Angeles, California). Four-inch cube of sandstone from the company's quarry, Flagstaff, Arizona. 22632.

**Armstrong, Thomas** (See under Pennsylvania Salt Manufacturing Company).

**Ashford, Edwin W.** (U. S. National Museum). Arrow-head from shore of Chesapeake Bay, Kent County, Maryland (22422); nest of Red Squirrel (*Sciurus hudsonius*) from the District of Columbia (22917).

**Askew, H. G.** (Tyler, Texas). Collection of land and fresh-water shells. 22299.

**Australian Museum** (Sydney, New South Wales, Australia), (through the United States Geological Survey.) Thirty-two specimens of minerals and rocks (22739). (Through Edward P. Ramsay, director of the Australian Museum.) Collection of Percoid fishes, representing 34 species (exchange) (23308).

**Avery, S. P.** (New York City). Sixteen prints by Procédé Comte, lithographs, and etchings (22515); etching by Henri Guécard, from the *Portrait of Whistler* (22951); catalogue *Atelier Jules Dupré*, illustrated by eight dry prints (23090).

**Avery, Dr. William C.** (Greensborough, Alabama). Collection of birds' skins, eggs, and nests (23293); nest and egg of *Guiraca cærulea* (23329); twelve skins of *Quiscalus quiscula* and *Quiscalus quiscula æneus* (23815).

**Babbitt, Miss Frank E.** (Coldwater, Michigan). Fragments of Indian pottery, bone spear-point, small leaf-shaped implement of white quartz, and flint arrow-points from various localities in Morrison and Beltrami Counties, Minnesota. 22706.

**Baker, W. S.** (Philadelphia, Pennsylvania), (through Mr. S. R. Koehler.) Four royal octavo volumes: "The engraved Portraits of Washington," Philadelphia, 1890; "Medallic Portraits of Washington," Philadelphia, 1885; "Character Portraits of Washington," Philadelphia, 1887; "Bibliotheca Washingtonia," Philadelphia, 1889; pamphlet—"The History of a rare Washington print," 1889. 23061.

Balch, Dr. Edward T. (South Bend, Washington). Two specimens of stone implements, and one specimen of sandstone from Willapa River, at low tide, June 1875. 23062.

Baldwin, I. W. (Cochranville, Pennsylvania). Arrow-points found in West Fallowfield Township. 22872.

Balfour, Henry (Oxford University Museum, Oxford, England). Six specimens of Carib celts from the West Indies (exchange) (23266); saucer-shaped lamp made of pottery from Cyprus (exchange) (22646). (See under Natural History Museum, Oxford.)

Bancroft, J. C. (Washington, District of Columbia). One Imari bottle, date 1650; one bowl Akahatayama, date 1800; one bowl, Kakiyewon (22855); one Bizen bottle, gourd-shaped, with handle (exchange) (22856).

Bangs & Co. (New York City), (through Mr. W. Eliot Woodward.) Collection of archæological specimens. 22813.

Baratonni, C. A. (See under E. Michel.)

Barnes, Judge W. H. (Tucson, Arizona). Specimen of embolite from Noon Camp, near Nogales (collected by Dr. W. F. Hillebrand, of the U. S. Geological Survey). 22601.

Barnum, Lieut. M. H., U. S. Army (Fort Pena, Colorado, Texas). Skin and eggs of Scaled Partridge (*Callipepla squamata*). (22239, 22372.)

Barrett, F. N. (New York City). Portrait of M. Appert, the inventor of the method of preserving food by hermetically sealing it in cans. 22501.

Barrett, O. D. (Washington, District of Columbia). Five specimens of hematite nodules from near Coyote, New Mexico. 22362.

Bartlett, Dr. John (Chicago, Illinois). Lines, sail-pin, and photograph of a Burmese canoe. 23250.

Bayley, Dr. J. R. (Newport, Oregon). Rock containing living specimens of boring mollusks, *Pholas*, *Lithodomus*, etc. 23244.

Bayley, Prof. W. S. (Colby University, Waterville, Maine). Two specimens of tin ore (exchange). 23036. (See under Colby University.)

Beach, Horace (Prairie du Chien, Wisconsin). Specimens of pearl-bearing river mussels, pearls, and cabinet specimen (one valve polished). 22450.

Bean, Barton A. (U. S. National Museum). Two birds (in flesh) from base of the Washington Monument. 22406.

Bean, Dr. T. H. (U. S. National Museum). Skin of Pacific Kittawake (*Rissa tridactile pollicaris*), and stone lamp from Kodiak Island, Alaska (22694, 22762); cedar bark-beater, from Skidgate, British Columbia. (22762.)

Beath, J. W. (Philadelphia, Pennsylvania). Thirty-six specimens of cut stones, consisting of onyx, cameos, bloodstone intaglio, hematite intaglios, moss-agate, sardonyx cameo, carnelian, agate armlet, agate paperweight, opalescent quartz (cut), opal in limonite (cut), etc. 22379.

Becker, G. F. (See under Interior Department, U. S. Geological Survey.)

Becker, M. J. (Fort Scott, Kansas). Two concretions, one containing sphalerite and one pyrite. 23326.

Beckwith, Paul (U. S. National Museum). Bronze medal, organization of the First Regiment Pennsylvania National Guard, 1861; brass medal, unveiling statue of General Meade, October 8, 1887 (22312); book "The Spellbinders' Souvenir" (22395); Union Veteran Union badge (22549); five button-hole badges—Order of the Mystic Shrine; Independent Order Good Templars; Knights of Pythias; Knights of Pythias Uniform Rank; Knights of the Golden Eagle (22628); catalogues of coins and medals of some of the large collections in England (23306).

Belding, L. (Stockton, California). Seven specimens, representing four species of birds' skins, including the recently described *Turdus sequoiensis* Belding (22191); alcoholic specimens of mammals, *Lagomys princeps*, *Spermophilus Richardsoni*, var. *L. Beldingi*, Merriam, *Putorius longicauda*, *Tamias asiaticus quadrivittatus*, *Thomomys talpoides umbrinus*, *Tamias lateralis* (22268); three skins of *Lagomys princeps*,

Belding, L.—Continued.
and five skins of *Tamias lateralis*, from Tahoe (22374); Belding's Sparrow (*Ammodramus Beldingi*), parent of nests and eggs in collection from San Diego (23131); eggs of *Cyanocitta stelleri frontalis*, and *Contopus borealis*; nests and eggs of *Ammodramus Beldingi*, *Parus montanus*, and *Turdus aonalaschkæ* (23132).

Bement, C. S. (Philadelphia, Pennsylvania). Specimen of native silver in native copper from Lake Superior (23334); specimen of pollucite from the Isle of Elba (23225).

Benedict, James E. (St. Paul, Minnesota). Skin of Bronzed Grackle (*Quiscalus quiscula æneus*), showing remarkable malformation of lower mandible. 22493.

Benedict, W. H. (Elmira, New York). Specimens of minerals from Moriah (exchange) 22346.

Bennett, F. C. (Monroe, Wisconsin). Four specimens of pearl-bearing *Unio*, representing four species from Sugar River, Green County. 22462.

Benson, Lieut. H. C. (U. S. Army). Three eggs (one set) of Long-crested Jay (*Cyanocitta stelleri macrolopha* Baird). 22214.

Bentz, W. H. (Georgetown, New Mexico). Two specimens of descloizite and one specimen of descloizite and vanadinite (collected by Dr. W. F. Hillebrand, of the U. S. Geological Survey). 22538.

Bergen, Miss Hilda H. (Brooklyn, New York). One copper and one silver coin from Finland. 22460.

Berger & Wirth (New York City). Specimen of prepared zinc, for zincography. 22540.

Betty, Dr. E. G. (Cincinnati, Ohio). Seven varieties of medals of the Ohio Valley Centennial Exposition held at Cincinnati; collection of half dollars of 1829, 1833, and 1839, and sixteen copper, silver, and nickel coins of various dates. 22906.

Biayus, B. H. (Marlborough, Maryland). Living specimen of Red-shouldered Hawk (*Buteo borealis*). 22225.

Billopp, Dr. J. S. (Glenn Dale, Maryland). Virginia half penny, George III, 1883. 23150.

Binney, W. G. (Burlington, New Jersey). Nineteen specimens of land-shells, to complete the Binney collection in the National Museum (22203); three specimens of *Succinea obliqua* Say, from Tarrytown, New York (collected by Mr. W. G. Teator) (22478); ninety-two electrotypes of shells (23129). (See under T. D. A. Cockerell.)

Birkenbine, John (See under Witherbees, Sherman & Co.)

Black, Alexander C. (Surgeon-General's Office, Washington, District of Columbia). Upper portion of a grooved ax, found on South A street, Washington, District of Columbia. 22857.

Blankinship, J. W. (Springfield, Missouri). Collection of prehistoric implements, sixty specimens of rude scrapers, knives, arrow-heads, perforator, and fragments of large leaf-shaped implements from old Indian camping ground. 22302. (See under Drury College.)

Bliss, Lawson S. (Dallas City, Illinois). Small flint implement. 22909.

Blunck, A. E. (Johnstown, New York). Blue Andalusian hen. 22142.

Boehmer, George H. (Smithsonian Institution). Specimens of stilbite, heulandite, Iceland spar, mesolite, native sulphur, chalcedony, and specimens of ores, rocks, and fossil plants from Iceland. 22371.

Boggs, J. G. (Washington, District of Columbia). Pair of living Guinea Pigs (*Cavia aperia*). 22755.

Bohrer, C. C. (Bethesda, Maine). Four living Red Foxes (*Vulpes fulvus fulvus*). 23152.

Bolton, Prof. H. Carrington (New York City). (See under Francis Gay.)

Bond, L. W. (Port Henry, New York). Slab of Potsdam sandstone with trails, and a block of Upper Cambrian or Potsdam sandstone. 23681.

Bond, Edward T. (Oceanside, California). Railway guide-books collected by the donor. 22286.

Bonnet, Peter (United States Treasury Department). Thirty-five photographs of Eskimos and of Alaskan scenery. 22911.

Boss, E. F. (Petosky, Michigan). Specimens of fossils *Cyathophyllum davidsoni*, E. and H., *Favosites* sp.? and coral. 22839.

Boston, William G. (David City, Nebraska). Five ears of yellow corn. 23052.

Bosworth, Prof. Frank (Chicago, Illinois). Specimens of limonite from near Mazarn, Arkansas. 23239.

Botanic Garden (Cape Town, Cape of Good Hope, Africa), (through P. MacOwan, director). Capsules of *Unaria procumbens*, *Unaria Burchellii*, and *Rogena longiflora*. 23289.

Boucard, A. (Paris, France). Seven specimens, representing seven species, of Birds of Paradise (22488); specimen of *Manncodia atra* from New Guinea (22489): skin of Rifle-bird (*Craspedophora magnifica*) from samo locality (22697).

Boucher, William, Jr. (Baltimore, Maryland). Three banjos of the styles made in 1845, 1846, and 1847, by Mr. Boucher (the inventor of tightening banjo-heads by screw fixtures), showing the first method and two subsequent improvements. 22989.

Boutelle, Capt. F. A. (Superintendent of the Yellowstone National Park, Mammoth Hot Springs, Wyoming). Six living specimens of Clark's Nutcracker and two living specimens of Steller's Jay. 23229.

Boutelle, Harry M. (Mammoth Hot Springs, Yellowstone National Park, Wyoming). Horseshoe with the words "Mammoth Hot Springs, Y. N. P., 1889." covered with calcareous deposits. 22597.

Brady, J. H. (Department of Public Education, South Africa), through Mr. William Harvey Brown. Collection of coleoptera (exchange). 23288.

Branham, H. P. (Department of Agriculture). Glass flute, silver-mounted, made by Laurent, of Paris, and used for many years by Judge A. B. Longstreet, of Georgia. 22817.

Breed, Dr. Daniel (Washington, District of Columbia). Specimen of stalactite from Howe's Cave, New York. 22794.

Bremen, M. H. (Silver City, New Mexico). Specimen of native silver in slate (collected by Dr. W. F. Hillebrand, of the U. S. Geological Survey). 22552.

Bremerman, Fielde (Philadelphia, Pennsylvania). Gray Rabbit (*Lepus sylvaticus*) from Falls Church, Virginia. 22800.

Brewster, William (Cambridge, Massachusetts). Eggs of *Tympanuchus cupido* and *Columba fasciata vioscæ* (new to the collection). 23133.

Briggs, C. H. (Kankakee, Illinois). Specimen of soap rock from Ventura County, California. 22566.

Briggs, S. (Washington, District of Columbia). Living specimen of Macaque Monkey from Macassar, Celebes, brought to the United States on the U. S. steamer *Brooklyn*. 22475.

Brigham, G. L. (Boston, Massachusetts). Specimens of petalite, yttrocerite, mica, allanite, serpentine in calcite, boltonite in calcite, scapolite in quartz, scapolite, chiastolite (22359, 23187).

Brimley, H. S. and C. S. (Raleigh, North Carolina). Two Pine-mice (*Arvicola pinetorum*). 22791.

British Museum (London, England). Fifty-seven specimens, representing 27 genera and 34 species of Cambrian, Lower Silurian, and Upper Silurian fossils (exchange).

Cambrian system: *Agnostus nudus* Barrande, *Conocephalus striatus* Barrande. *Conocephalus sulzeri* Barrande, *Conocortphe viola*, *Arionellus ceticephalus*, *Ellipsocephalus hoffi* Barrande, *Sao hirsuta* Barrande.

Ordovician system: *Trinucleus ornatus* Sternberg, *Dionide formosa* Barrande, *Ogygia* (*Asaphus*) *corndensis* Murchison, *Asaphus tyrannus* Murchison var. *Ornatus* Murchison.

BRITISH MUSEUM—Continued.

Silurian system: *Leperditia baltica* Wahl., *Ampyx renaulti* Barrande, *Calymene blemenbachii* Brogniart, *Calymene ceratocephala*, *Homalonotus delphinocephalus* Green, *Illænurus barriensis* Murchison, *Phacops caudatus* Brunn., *Phacops downingiæ* Murchison, *Cheiturus bimucronatus* Murchison, *Sphærexochis mirus* Barrande, *Staurocephalus murchisoni* Barrande, *Amphion fischer* Eichwald, *Encrinurus punctatus* Wahl., *Cromus bohemicus* Barrande, *Acidaspis mira* Barrande, *Acidaspis brightii* Murchison, *Acidaspis rœmeri* Barrande, *Acidaspis* sp.? *Lichas hirsuta* Fletcher, *Arethusina konincki* Barrande, *Proetus latifrons* McCoy, *Harpes ungula* Barrande (22580).

Skull of *Lutra felina* (22589); three meteoric casts and one specimen of orphiment (22189); collection of bats from the British Museum collection (22680); 86 specimens of minerals (23064).

BROOKS, L. F. (Boston, Massachusetts). Specimen of native tellurium in quartz from Boulder County, Colorado. 22952.

BROWN, C. A. (Honolulu, Hawaiian Islands). Three specimens of Awa (Kava) representing the varieties Puna, Makea and Papa. 22869.

BROWN, C. F. (Hot Springs, Arkansas). Specimens of ægirite in microlcine, quartz crystals and pebbles and quartz crystal with inclusions of albite (22806); specimens of manganese dendrite on novaculite (22837).

BROWN, Herbert (Tucson, Arizona). Twenty-one eggs of *Harporhynchus bendirei* (22481); specimen of snake (22894); 67 eggs (19 sets) of *Harporhynchus curvirostris palmeri*, 10 eggs (1 set) of *Callipepla squamata* (22903); specimen of Gecko, (*Coleonyx variegatus*); three specimens of *Chilomeniscus ephippicus* (22928); two pairs of Gambel's Partridge (*Callipepla gambeli*) (22962); specimen of lizard (23029); two quail's eggs swallowed and ejected by a Gila monster (23128); eggs of *Callipepla gambeli*, *Columbigallina passerina pallescens*, *Ardea virescens*, *Melopelia leucoptera*, *Polioptila plumbea*, *Cardinalis cardinalis superbus*, and *Phainopepla nitens* (23296).

BROWN, Miss L. H. (Boston, Massachusetts). Two platinotype prints. 22953.

BROWN, Mrs. HELEN C. Living specimen of Macaw from Honduras. 22645.

BROWN, Mrs. M. E. (Orange, New Jersey.) Three musical instruments (exchange). 22588.

BROWN, THOMAS S. (Poughkeepsie, New York). First straight knife or sickle belonging to the Ogle-Brown reaping machine, invented or suggested by Henry Ogle, and built by Thomas R. Brown, assisted by his son, at Alnwick, England, about the year 1820. 23285.

BROWN, WILLIAM HARVEY (See under John H. Brady); (see also under U. S. Eclipse Expedition to Africa and Rev. G. H. R. Fisk).

BROWNELL, FRANK E. (U. S. Pension Office). Double-barreled shot-gun, with which Col. E. E. Ellsworth was shot at the Marshall House, Alexandria, Virginia, May 24, 1861; and rifle, with bayonet attached, with which James P. Jackson (who killed Ellsworth) was shot at the same time and place. 22306.

BRUFF, Mrs. J. G. (Washington, D. C.). Collection of medals, coins, specimens of paper money, books, plumbeotype "Sir R. Pakenham," lithograph "Washington," mezzotint "The Washington Family" (22243); collection of ethnological and archælogical objects numbering 1,487 specimens (22308).

BRYAN, CHARLES E. (Washington, District of Columbia). Living specimen of alligator *Alligator mississippiensis*. 23221.

BUCK, HARRY H. (Orland, Maine). Builder's models of two schooners. 22819. (See under W. H. Abbott.)

BUCKLAND, JOHN M. (Rockford, Iowa). Twelve specimens, representing four genera and six species of *Spirifera hungerfordi* Hall, *Sperifera disjuncta* Hall, *Atrypa aspera* Schlatheim, *Atrypa reticulares* Linnæus, of the Devonian Chemung formation. 22669.

**Buehring, Fred.** (New York City). Lithographers and photographers' directory of New York City, for 1889. 22319.

**Buie, Dr. D. M.** (Burgaw, North Carolina). Specimen of grass used as a purgative. 22929.

**Burch, R. A.** (through W. B. Merrimon, U. S. National Museum). Specimen of copper ore from the Yancey Mine, near Allensville, North Carolina. 22551.

**Burdick, Mrs. Hilda** (Pine Mountain, Georgia). Specimens of minerals from Laurel Creek Mines, consisting of diaspore, pink margarite, phlogopite, phlogopite crystals coated by pyrophyllite, apatite with phlogopite, corundum, margarite with ripidolite and chlorite, corundum with ripidolite and chlorite, tourmaline and vermiculite, apatite in phlogopite (collected by Mr. W. S. Yeates, of the U. S. National Museum.) (22396, 23065.)

**Bureau of Ethnology** (through Major J. W. Powell, Director). Duplicate of a model of Wolpi, one of the Tusayan villages (23175); model of Tewa (23193); model of Sechomovi (23192). (Through Mr. James Mooney:) Collection of ethnological objects procured from the East Cherokee Reservation, North Carolina, consisting of baskets, moccasins, polishing-stones, conjuring-stones, scratchers, bullet mold, lancet, cupping-horn, etc. (21450).

**Burger, Peter** (U. S. National Museum). Iron tinder-case for the pocket, in use many years (22385); set of cooper's tools, bullet-molds, and cooper's plane (22567).

**Burns, Frank** (Smithsonian Institution). Specimens of *Ostrea virginica*, attached to a teapot cover, from the Lower Potomac River (22531); 8 specimens of *Succinea campestris* Say, from 3 miles east of Chattahoochee, Florida (22875); Ivory-billed Woodpecker (*Campephilus principalis*), and Pileated Woodpecker (*Ceophlœus pileatus*) (22682); 21 shells from Alum Bluff, Florida (22388).

**Burton, W. M.** (Standard Oil Company, Cleveland, Ohio). Three specimens of distilled zinc and magnesium, used in the determination of the atomic weights of these metals. 23241.

**Buysson, Viscount R. du** (Chateau de Vernet, par Bron-Vernet (Allier), France). Seventy-seven specimens, representing 26 species of *Chrysididæ* (mounted) (exchange) 23092.

**Call, Dr. S. J.** (Paso Robles, California). Specimen of Band-tailed Pigeon (*Columba fasciata*). 22769.

**Camp, J. H.** (Herring, Ohio). Collection of insects, crystals, minerals, and metals, specimens of Musa and Pancratium, palm-fiber from which rope, cloth, tops, mats, and many other objects are made; gum copal, African rubber, cocoon of Congo silk-worm, hippopotamus tusks, piece of skin from an animal called by the English "Congo seal," and elephant hair from the Congo district, Africa (22377); alcoholic specimens of white ants (22439).

**Campbell, G. R. & Co.** (Cherryfield, Maine). Builder's skeleton model of brig. 22651. (See under W. H. Abbott.)

**Candage, R. G. F.** (Boston, Massachusetts). Builder's model of vessel of 1876. 22732.

**Carey, Harriet W.** (Napoleon, Ohio). Looking-glass, relic of James Mason of the Plymouth colony. 22479.

**Carlton, Dudley A.** (Sedgwick, Maine). Model of figure-head of brig. 22651. (See under W. H. Abbott.)

**Carlisle, Harold** (Durango, Colorado). Twenty specimens of *Gryphæa pitcheri* Mort. from Great Sage Plain, valuable as showing geographical distribution. 225[illegible].

**Carolina Wood Veneer Works** (Clinton, North Carolina), (through S. G. Worth, U. S. Fish Commission). Butter-dishes, and the strips of gum and timbers used in manufacturing them. 22808.

**Carpenter, P. Herbert** (Eton College, Windsor, England). Thirty-four microscopic slides, sections of shells, twenty-seven microscopic slides of foraminifera, annelid tube, and one slide of crab-shell, prepared by the late Dr. W. B. Carpenter, and collected by H. M. S. *Porcupine*, *Valorous*, *Lightning*, and *Challenger*. 22910.

**CARPENTER, Capt. W. L.**, (U. S. Army) Fort Whipple, Arizona. Specimens of reptiles; specimens of *Salmo irideus*, *Gila*, *Squalius*, *and Catostomus*, collected in the Verdi River and its tributary Oak Creek; 6 specimens of insects, consisting of spiders, scorpions, and scolopendra (22517); Rocky Mountain Lined-tailed Spermophile (*Spermophilus grammurus*) (22525).

**CARTER, Mrs. SIBYL** (Washington, District of Columbia). Collection of ethnological objects consisting of feather-plume, hat, wallet, fan, bowl, Tapa club, carrying-pole, photographs, etc., from the Sandwich Islands, and specimen of "Peles hair" from the Hawaiian Islands. 23273.

**CASEY, Capt. T. L.** (Army Building, New York City). Types of 9 new species of North American coleoptera (exchange). 22824.

**CASSIN, JOSEPH A.** (Piney Point, Maryland). Living specimen of Fish-hawk. 22296.

**CHAMBERLIN, T. C.** (See under Interior Department, U. S. Geological Survey.)

**CHANDLER, Prof. CHARLES F.** (School of Mines, Columbia College, New York City.) Thirty specimens of photo-mechanical printing, and similar work. 22418.

**CHAPMAN, J. LINTON** (Brooklyn, New York). Wood engravings, pamphlet, and specimen of medal-ruling. 22950.

**CHASE, E. S.** (Hailey, Idaho). Leaf-shaped implement of obsidian. 22328.

**CHATARD, Dr. T. M.** (U. S. Geological Survey.) Two specimens of Urao, prepared by Dr. Chatard, crystals of potassium platinic chloride. 22180.

**CHENEY, S. F.** (Grand Manan, New Brunswick). Specimens of nudibranchs, pebbles, worms, crustaceans and sponges (22408, 23294).

**CHIROUSE, E. C.** (See under Interior Department.)

**CHRISTY, THOMAS & Co.** (London, England.) Specimen of Ouabain, the new heart poison. 23002.

**CHURCH, JOSEPH & Co.** (Tiverton, Rhode Island). Alcoholic specimen of Menhaden (*Brevoortia tyrannus*), 17 inches long, caught at Long Branch, New Jersey. 22562.

**CINCINNATI MUSEUM ASSOCIATION** (Cincinnati, Ohio). Drawings by students in the Cincinnati Art Academy. 22192.

**CISSEL, GEORGE E.** (District of Columbia). Specimen of Flicker (*Colaptes auratus*), in flesh. 23112.

**CLARK, A. HOWARD** (U. S. National Museum). Copy of J. Walker Thompson's publication entitled "Advertising in America." 22711.

**CLARK, E.** (Georgetown, New Mexico). Specimens of smithsonite and calcite from Hanover Gulch. (collected by Dr. W. F. Hillebrand, of the U. S. Geological Survey). 22542.

**CLARK, WALDO J.** (Mullan, Idaho). Specimens of plattnerite. 22382.

**CLARKE, Prof. F. W.** (See under Dr. C. Winkler, Interior Department, U. S. Geological Survey.)

**COALE, HENRY R.** (Chicago, Illinois). Specimen of Broad-winged Hawk (*Buteo latissimus*) with fully developed toe and claw growing from the thigh. 22969.

**COCKERELL, T. D. A.** (Colorado Biological Association, West Cliff, Colorado), (through W. G. Binney). Specimen of *Prophysaon pacificum cockerell*, type, from Victoria, Vancouver Island. 23227. (See under Colorado Biological Association.)

**COFFIN, Hon. V. L.** (Harrington, Maine). Builder's model of half-brig schooner. 22648. (See under W. H. Abbott.)

**COLBURN, A. E.** (Washington, District of Columbia). Specimen of Red-headed Woodpecker (*Melanerpes erythrocephalus* Linn) (22350); House Sparrow (*Passer domesticus*) with malformed bill (22749).

**COLBY UNIVERSITY** (Waterville, Maine), (through Prof. W. S. Bayley). Concretions from Princess Point (exchange). 23078.

**COLE, W. P.** (Washington, District of Columbia). Specimen of living Horned Lizard (*Phrynosoma platyrhinum*). 22274.

Collins, J. (Provincetown, Massachusetts). Two specimens of Thimble-eye (*Scomber pneumatophorus*) from Cape Town, Africa, caught by Capt. Josiah Chase. 22916.

Collings, Joseph Z. (Camden, New Jersey). Bicycle constructed by the donor in 1863. 22583.

Colorado Biological Association (West Cliff, Colorado), (through Mr. T. D. A. Cockerell). Specimen of fungus *Uromyces aconiti-lycoctoni* D. C., on a new host (22507); 3 specimens of *Pupa concinnula* Cockerell n. sp. from altitude 10,000 feet near Brush Creek, Custer County, Colorado, and an immature example of *Physa cupreonitens* Cockerell sp. juvenis, from Wellsville, Tremont County, Colorado. (22603).

Collister, J. C. (Chicago, Illinois). Casts of so-called footprints, discovered in the limestone formation near Forest City, South Dakota. 23161.

Comstock, Prof. J. H. (See under Cornell University.)

Conrad, Prof. A. H. (Western Normal College, Shenandoah, Iowa). Collection of about 400 specimens of fossils, mostly carboniferous, representing about 50 species (exchange). 22046.

Cook, E. P. (Wellfleet, Massachusetts). Specimen of herring. 23322.

Cook, George W. (See under Interior Department, U. S. Geological Survey.)

Cooper, J. G. (Hayward, California). Specimens of *Pisidium abditum* Hald., *Pisidium occidentata* Pr., *Pisidium compressum* Pr., *Sphærium truncatum* Pr., from Tuolumne County, California. 22627.

Cooper, W. B. (U. S. National Museum). Specimen of *Vaginulus floridanus*, found in a bunch of bananas. 23130.

Corbett, Howard (Arlington, Virginia). Specimen of Screech Owl (*Megascops asio*). 22798.

Cornell University (Ithaca, New York), (through Prof. J. H. Comstock). Four pairs of *Cephus pygmæus*, a pest recently imported into the United States (new to the collection.) 22484.

Corson, John (Washington, District of Columbia). Living specimen of Gray Squirrel. 22476.

Coues, Dr. Elliott (Smithsonian Institution). Specimen of mounted peacock (*Pavo cristatus* Linn). 22360.

Cousins, Hamen (Lamoine, Maine). Builder's model of two-masted schooner. 22654. (See under W. H. Abbott.)

Cowen, Philip (New York city). Megillah (Easter roll). 22327.

Cox, Joseph W. (Accotink, Virginia). Ax made of quartzite found about 300 yards northwest of the Woodlawn mansion in Fairfax County. 23315.

Cox, Phillip (New Castle, New Brunswick). Alcoholic specimens of *Semotilus corporalis*, *Rhinichthys atronasus* and *Phoxinus neogæus*. 22592.

Cox, Mrs. S. S. (New York city). Decorations of the order of "The Mjidich," conferred by the Sultan of Turkey upon Hon. S. S. Cox, and the decoration of the order of "The Shefakat," conferred by the Sultan on Mrs. Cox. 22714.

Cox, W. V. (Chief Clerk, U. S. National Museum). Copy of "Zanesville Daily Signal" of April, 1833. 22801.

Cramer, Stuart W. (U. S. Assay Office, Charlotte, North Carolina). Specimen of meteoric iron from Rutherford County. 22942.

Crandall, A. E. (Lexington, Kentucky), (through Prof. Joseph F. James). Fifteen specimens of *Orthis linneyi* James, from the Cincinnati formation of the Lower Silurian formation. 22443.

Crawford, James B. (Castine, Maine).. Builder's model of full-rigged ship. 22652. (See under W. H. Abbott.)

Crawford, John. (See under Government of Nicaragua.)

Cressingham, R. H. (New York city). "New York Gazette or Weekly Post Boy," May 12, 1755; "Republic of Rio Grande," June 6, 1846, published by General Taylor's troops while at Matamoras, Mexico; "Boletin de la Division del Norte," Matamoras, April 14, 1846. 22975.

Cresson, Dr. H. T. (Philadelphia, Pennsylvania). Collection of rude implements from Pennsylvania and the District of Columbia. 23198.

Crosby, C. H. (Bridgeport, Connecticut). Specimens of partridge Cochin hen, chicken, and feathers. (23100, 23178, 23211, 23246).

Crosby, F. W. (Washington, District of Columbia). Specimens of contorted schists from Dutch Island in Narragansett Bay, Rhode Island, and specimen of shell marl from Aquia Creek, Virginia. 22880.

Culin, Stewart (Philadelphia, Pennsylvania). Paper money of various kinds, burned at funeral ceremonies by the Chinese in the United States. 23292.

Culinan, Andrew (Washington, District of Columbia). Living Pied-billed Grebe (*Podilymbus podiceps*). 23074.

Cunningham, Roger (Kansas City, Missouri). Collection of tools, plates, and proofs, illustrating the wax process. 23084.

Cunningham, Thomas S. (Chicago, Illinois). Sheet-lead impression taken from a historic inscription on Spanish Rock, Bermuda. The inscription is supposed to have been cut in the face of the rock by Ferdinand Camelo, a Spanish navigator. The inscription consists of a combination of letters, and an emblem, evidently a St. George's cross. The rock is overhung by a stunted red cedar tree, which has protected it from the elements. From this tree were cut the implements from which the cast was taken, and which accompany the impression sheet. 23168.

Curtin, Jeremiah (Covele, California). Ethnological specimens from the Hupa Indians. 22591.

Dall, Dr. William H. (U. S. Geological Survey). Collection of spiders and myriapods, collected by the donor on Gibson Island, Chichagoff Harbor, Alaska, (22216); pair of horns of the Kamtschatka Snow-sheep (*Ovis nivicola*) from Palmer Bay, East Siberia (22258); collection of Cambrian fossils from Canada; 6 fine specimens of *Dictyonema sociale* Salter, from the Upper Cambrian, Matanne, Quebec Province (22410); land and fresh-water shells from East Parsonsfield, Maine (22433); specimen of bat *Vesperugo serotinus* in flesh (22708).

Dall, Charles W. (Washington, District of Columbia). Hornet's nest. 22586.

Daniel, Dr. F. E. (Austin, Texas). Specimen of *Stratægus julianus* Bur. 23328.

Dawson, Sir J. William. (See under Peter Redpath Museum.)

Day, Moses B. (Sedgwick, Maine). Builder's model of schooner. 22658. (See under W. H. Abbott.)

Day, Dr. D. T. (U. S. Geological Survey). Specimen of garnierite, from New Caledonia. 22842. (See under Witherbees, Sherman & Co.)

Deering, D. A. (Independence, Iowa). Forty-one specimens, representing 7 genera, and 11 species of Devonian Brachiopoda. 22788.

Deery, Thomas P. (Washington, District of Columbia). Pair of living domestic fowls, Houdan variety. 22750.

Degeler, F. A. (Chehalis, Washington). Concretions of clay-iron stone (carbonate of iron), from the banks of the Salmon Creek. 22426.

De Golier, W. F. (Tarpon Springs, Florida). Collection of marine shells, turtle-eggs, horseshoe crabs, sponges, sea urchins, corals and gorgonian. 22904.

De Graff, J. T. (Amsterdam, New York). Rosecomb black African bantam hen (22970); two black African Rosecomb bantam chickens (23195).

De Jonge, Louis & Co. (New York City). Two photo-mechanical color-prints, made by Messrs. Meissner & Buch, Leipzig, Germany (purchase). 22438.

De Mott, W. (Tecumseh, Michigan). Specimen of Golden-crowned Kinglet (*Regulus satrapa*), in flesh. 23066.

Dennis, Col. George E. (Rocky Mount, Virginia), (through Mr. N. T. N. Robinson, Washington, District of Columbia). Collection of currency of the Confederate States of America. 22278.

Devoe, F. W. & Co. (New York City). Two copies of priced and illustrated catalogue of artists' materials. 22556.

**DEYROLLE, EMILE** (Paris, France). Collection of mammal skins, consisting of *Moschus moschiferous*, *Phacochœrus æthiopicus*, *Hydrochœrus capybara* (purchase) (22260); *Semnopithecus schistaceus*, *Mycetes niger*, *Ateles belzebuth*, *Cebus capucinus*, *Hapalemur griseus*, *Antechinus unicolor*, *Phascogale flavipes*, *Cuscus maculatus*, *Phalanger maculatus*, *Halmaturus nalabatus*, *Macropus nalabatus*, and *Ursus malayanus* (23039).

**DILLER, J. S.** (See under Mrs. J. H. Tourtelette.)

**DOE, Mrs. WILLIAM H.** (District of Columbia). Capuchin Monkey (*Cebus apella*) in flesh. 23069.

**DONOHOE, JOSEPH A.** (Astronomical Society of the Pacific, San Francisco, California). Comet medal of the Astronomical Society of the Pacific founded by the donors. 23114.

**DORIA, MARQUIS GIACOMA.** (See under Museum of Natural History, Genoa, Italy

**DORITZ, ROBERT** (Sargentville, Maine). Builder's model of schooners. 23659. (See under W. H. Abbott.)

**DORSEY, CLEMENT** (Washington, District of Columbia). Specimen of Yellow Fantail Pigeon and Ice Pigeon. 22390.

**DORSEY, Rev. J. OWEN** (Bureau of Ethnology, U. S.) Two models of fishhooks, and model of retrieving harpoon from Năl-tŭnné-tunné Indians, Oregon. 22492.

**DOUGAL, WILLIAM H.** (District of Columbia). Copper plate with gradations in dry-ground aquatints. 23188.

**DOWLING, THOMAS** (Washington, District of Columbia). Specimens of pottery (Japanese or Chinese), cloisonné, bronzes. drums, and carved-wood brazier. 22854.

**DOWNMAN, R. H.** (Warrenton, Virginia). Two young Woodchucks (*Arctomys monax*) (22271); specimen of living Great Horned Owl (*Bubo virginianus*) (22349); specimen of Barred Owl, in flesh (22495).

**DRIVER, GEORGE W.** (Washington, District of Columbia). Living specimen of Woodchuck (*Arctomys monax*). 22500.

**DRURY COLLEGE** (Springfield, Missouri), (through Mr. J. W. Blankinship). Collection of plants, consisting of about 160 specimens, selected from the flora of southwestern Missouri. 22179.

**DUCHESNE, LEON C.** (Natchez, Mississippi). Specimens of Confederate States paper-money. 22830.

**DUDLEY, Prof. W. L.** (Nashville, Tennessee). Two specimens of vivianite from Kentucky. 22981.

**DUFOUR.** Dr. F. (Riverdale, Maryland). Specimen of Meadow lark (*Sturnella magna*) in flesh (22257); specimen of Marsh Hawk (*Circus hudsonius*), in flesh from Eggbornville, Virginia (22765).

**DUFOUR**, Dr. J. T. R. (Washington, District of Columbia). Black-throated Blue Warbler (*Dendroica cœrulescens*) from Riverdale, Maryland. 22411.

**DUGÈS**, Dr. Alfred (Guanajuato, Mexico). Collection of alcoholic fishes, consisting of *Goodea atripinnis*, *Characodon ferrugineus*, *Zophendum australe*, *Characodon variatus*, *Algansea dugesi*—new species, *Algansea australis* Jordan, *Notropis altus* Jordan, and *Hudsonius altus* Jordan. Alcoholic and dry insects, consisting of orthoptera; *Stagmanantis limbata* (five species). Neuroptera, Arachnida, Hemiptera, Hymenoptera (*Monomorium pharaonis*), Lepidoptera, and Diptera. Alcoholic marine invertebrates, consisting of Echinus, Amphipods, Nephelis, Intestinal worms, and Palæmon. Alcoholic and dry shells, consisting of *Helix cicatricosa* Müller from China; *Limax americanus* Tate, from Mexico; *Bulimulus* (jv.). Orizaba, *Planorbis Oaxaca*, Mexico, and specimens of Planarian worms (*Anodonta aratina* L. Reptiles, consisting of *Spea dugesi*, *Amblystoma dumerito*, *Spea multiplicata*, and *Spea hammondii*. Fragments of a human skull. Birds' skins, consisting of *Harporhynchus curvirostris* juv., artificially colored; *Geothlypis trichas occidentalis*, *Euphonia elegantissima*, and *Porzana carolina*. Specimen of *Hesperomys melanophrys* Coues

Dugès, Dr. Alfred—Continued.

Plants, consisting of *Abutilon*, *Acacia*, *Ambrosia psilostacha* D. C., *Boussingaultia baseloides* Dict., *Calamintha macrostema* Benth., *Carica*, species ignota; *Chenopodium album*, *Dalea greggii*, probably Gray; *Jacobinia*, *Lapidium lasiocarpum* Nutt., var. *tenuipes* Wats.; *Lolelia laxiflora* H. B. K., var. *ungustifolia* Gray; *Macrosiphonia hypolenca* Muell., *Prunus*, *Solanum alæagnifolium* Cav., *Sonchus oberacens* L., *Taraxacum officinale* Weder, *Jetramerium hispidum* Nees, *Viguiera quinqueradiata* Gray, *Symphoricarpus microphyllus* H. B. K., *Eryngium alpinum* L., and *Conium maculatum* L. 23254.

Dungan, Leslie W. (New Orleans, Louisiana). Two living Alligators. 22620.

Durand, John (Paris, France). Three mechanical birds. 22553. (See under Government of Nicaragua.)

Duschak, Adolph (Buffalo, New York). Two plaster casts of human skulls, the originals of which were found on White's Island, Niagara River. 22194.

Dutcher, William (New York City). Specimen of Loon (*Urinator imber*) in flesh from Montauk, Suffolk County, New York. 23166.

Duvall, George W. (Annapolis, Maryland). Portion of common viper snake. 23108.

Earll, R. Edward (U. S. National Museum). Six-kreutzer piece of the Rhennish Palatinate, made of composition metal, dated 1808. 22361.

Earnshaw, Isaac (Oldham, England). Carboniferous fossil plants (exchange). 22889.

Eckert, George L. (Washington, District of Columbia). Copper coin (one-quarter real) from Chihuahua, Mexico. 23009.

Edwards, Miss Amelia (no address given). Egyptian figure. 22984.

Edwards, Vinal N. (Woods Holl, Massachusetts). Living specimens of common Brant Goose (*Branta bernicla*) (22224); specimen of *Nomeus gronovii*, taken at Menemshe Bight (22231). (See under Fish Commission, U. S.).

Eigenmann, Mrs. Rosa Smith (San Diego, California). Alcoholic specimens of fishes, crabs, shrimps, and mollusks, chiefly *Chitons*. 22956.

Elliott, C. E. (Webb City, Missouri). Specimens of sphalerite from Noble's mine; smithsonite on sphalerite from Garrison mine; and smithsonite from Oronogo mine. 22427.

Elrick, W. R. (Chicago, Illinois). Specimen of rose quartz, from Dakota; specimens of pyrite and limonite, from Ishpeming, Michigan (exchange). 22437.

Emerson, W. C. (Haywater, California). Three eggs of *Callipepla californica* (22861); nest and three eggs of *Melospiza fasciata samuelis*, nest and four eggs of *Melospiza fasciata heermanni*, and nest and four eggs of *Empidonax difficilis* (22940).

Emery, Mrs. M. G. (Washington, District of Columbia). Series of illustrated newspapers. 23267.

Emmert, J. W. (Bristol, Tennessee). Paper-weight composed of stalagmite marble. 22365.

Emmons, Lieut. George (U. S. Navy). Four photographs, illustrating witchcraft in Alaska, Hydahs, and Tlingits; wallet in process of plaiting, Washington (22759); Haida whistle to imitate the call of young deer from southern part of Prince of Wales Island, Alaska (22912.)

Emmons, Prof. S. F. (See under Interior Department, U. S. Geological Survey.)

English, George L. & Co. (Philadelphia, Pennsylvania). Five specimens of vanadinite from Yuma County, Arizona, and specimen of chrysocolla from the "Copper Queen" mine (22572); specimen of malachite from the "Copper Queen" mine, and specimen of harmotome from Strontian, Argyleshire, Scotland; specimen of lithiophilite from Branchville, Connecticut; and specimens of calcite and aragonite from Cumberland, England (22870).

Ethnological Museum (Berlin, Germany). Collection of ethnological objects, consisting of baskets from Morocco, Africa; pipe, tobacco-pouch, lances, and basket, Ethnological Museum (Berlin, Germany)—Continued. made by the Wasagua negroes; comb, woman's fringe dress, tortoise-shell dish, from Palao, South Pacific Ocean; woman's dress from New Caledonia; and from Adansonia, South Pacific Ocean (exchange). 23146.

Faison, Walter E. (Washington, District of Columbia). Living specimen of Albino squirrel from North Carolina. 22754.

Farnham, A. B. (Bladensburgh, Maryland). Two Red Squirrels (*Sciurus hudsonius*); two White footed Mice (*Hesperomys leucopus*); two Pine mice (*Arvicola pinetorum*); Meadow Mouse (*Arvicola riparius*) (22997); skin of White-footed Mouse (*Hesperomys leucopus*) (23070).

Farrer, Henry (Brooklyn, New York). Copper plate engraved by soft-ground process, with proofs. 22641.

Felch, M. P. (Canyon City, Colorado). Six specimens of *Mactra canonensis* Meek. 22545.

Fick, G. A. (Baltimore, Maryland). Swallow-pigeon. 22612.

Fieg, Jacob (Washington, District of Columbia). Living specimen of Great-horned Owl (*Bubo virginianus*). 22226.

Field & Greenwood (Brownsville, Texas). Two birds' skins *Jacana spinosa* and *Sporophila morelleti* (exchange). 22238.

Fillette, St. Julian (Washington, District of Columbia). Photograph of U. S. steamers *Trenton*, *Vandalia*, and *Nipsic*, and H. G. M. steamer *Olga*, showing the harbor of Apia, Samoan Islands, taken after the hurricane of Saturday, March 16, 1889. 22218.

First Japanese Manufacturing and Trading Company (New York City). Collection of porcelain, bronze, ivory, carved wood, pottery, figures, and sword ornaments. 23303.

Fish Commission, United States:

(Through Col. Marshall McDonald, U. S. Commissioner of Fisheries):

Stuffed specimen of Sawfish (*Pristis pectinatus*) with 25 pairs of rostral teeth, its extreme length being 12 feet and 2 inches (22195); specimen of sheepshead (*Diplodus probatocehalus*), from Chesapeake Bay (collected by Mr. William P. Seal) (22404); two specimens of Pickerel (*Esox reticulatus*), and Weakfish (*Cynoscion regale*), from the aquaria (22423); two skeletons of Cormorants (*Phalacrocorax dilophus penicillatus*) (22864); specimen of Gull (*Larus glaucescens*), Short-billed Gull (*Larus brachyrhynchus*), Sandpiper (*Heteractitis incanus*) (22884); samples of dried hake sounds and manufactured sheet isinglass from the same (22607).

(Through Mr. Vinal P. Edwards, Wood's Holl, Massachusetts):

Specimens of eels, large-eyed anguilla, and small-eyed anguilla. 22533.

(Collected by the steamer *Albatross*):

Alcoholic specimens of fishes from the Galapagos Islands and northward. 22447.

Specimens from the western coast of North America, consisting of reptiles, insects, plants, human and mammal skulls, stone implements, shells, and birds' nests. 22772.

A series of the Echini from the north Pacific Ocean. 22849.

Alcoholic specimens of fishes from Alaska and British Columbia. 22851.*

Two hundred and twenty-six specimens of birds from the west coast of North America. 22762.

(Collected by Dr. D. S. Jordan):

Specimens of reptiles, batrachians, and insects from Virginia and elsewhere. 22810.

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* See Proceedings of the National Museum Vol. XII, pp. 641–642, and Vol. XIII, pp. 37–45.

**Fish Commission, United States**—Continued.

Type series of fishes, alcoholic shells, *Physa* (collected by Dr. D. S. Jordan in Yellowstone Park); alcoholic specimens of mammals and reptiles from the Yellowstone Park. 22828.

Type series of fishes from Colorado, Utah, and Kansas. 22852.

One hundred and fifteen specimens of crayfishes from Virginia, North Carolina, Tennessee, Michigan, and Indiana. 22900. Dr. Jordan was assisted in making this collection by Mr. C. H. Bollman.

See under Hon. V. L. Coffin; J. Kennedy; William Welch; G. R. Campbell and Company; James B. Crawford; D. A. Simpson; Hamen Cousins; C. L. Young; Isaac M. Grant; Abraham Lord; Moses B. Day; Robert Doritz; Joshua Watson; Dudley A. Carlton; F. L. Tyler; James G. Swan.

**Fisher**, Mrs. A. K. (District of Columbia). Ladies' hat made of feathers. 22340.

**Fisher**, Dr. A. K. (Department of Agriculture). Two specimens of Redpoll (*Acanthis linaria*) from Lake George, New York (22845); living specimen of Wood-mouse (22275). (See under Gideon Mabbett.)

**Fisk**, Rev. **George** H. R. (Cape Town, Africa), (through Mr. William Harvey Brown, of the United States *Eclipse* expedition). Collection of living South African tortoises, transferred to Zoölogical Park. Alcoholic specimens of South African tortoises and chameleons. 23247.

**Fletcher**, Prof. J. (Ottawa, Canada). Collection of rare Arctic coleoptera and lepidoptera. 22293.

**Ford, John** (Academy of Natural Sciences, Philadelphia, Pennsylvania). Specimens of *Crepidula fornicata* Linn., *Crepidula glauca* Ford, from Cape May, New Jersey, and two specimens of *Modiola tulipa* Linn, from Anglesea, New Jersey. 22719.

**Forney**, E. O. (Washington, District of Columbia). Two specimens of zircon in magnetite from Pricetown, Pennsylvania (22375); specimen of black tourmaline in prochlorite from the tunnel shaft, Washington aqueduct (22424).

**Fort Payne Coal and Iron Company** (Fort Payne, Alabama), (through Mr. John H. Mullin, superintendent.) Specimens of limonite, hematite, and impure pyrolusite from a mine on the property of the company. 23194.

**Fowke, Gerard** (Augusta, Kentucky). Small rude implement from the District of Columbia; arrow-point from Kentucky; rude implements; leaf-shaped implements; scrapers or knives of unusual forms; perforators and arrow-points from Ohio (exchange). 22473.

**Fox**, Master **Edward** E. (Washington, District of Columbia). Two living specimens of green Parrakeets from Central America. 22685.

**Francis, Joseph** (Minneapolis, Minnesota). Gold medal presented to Mr. Francis by the President of the United States, April 12, 1890, in accordance with act of Congress of August 27, 1888; gold box, diamond-mounted, presented by Napoleon III, Emperor of France, February 4, 1856. These were presented to Mr. Francis as testimonials of great service rendered in connection with his life-saving appliances. 23240.

**Fraser, Farley & Varnum** (Yokohama, Japan). Specimens of unfired teas, sun-dried teas, "Regular" machine-fired, and commercial packages. 22394.

**Freeman**, D. N. (Cardington, Ohio). Specimen of insect *Chelifer concroides* L. 23003.

**Friedenwald**, Dr. H. (Baltimore, Maryland). Hebrew map of Palestine, and two charts illustrating modern Palestinian art (22757); lamp, Passover bowl and spice box (purchase) (22844); Jewish horn or shofer (purchase) (22914); Hebrew sacrificial platter for Passover, made in Constantinople (purchase) (22985); Mizrach (23122).

**Fenwick**, W. (District of Columbia). Specimen of Loon (*Urinator imber*). 23154.

**Friedrichs Brothers** (Erie, Pennsylvania). White-crested living white Polish hen. 23183.

**Frost**, L. L. (Susanville, California). Fire drill and and fishhook of the Nokum Indians, 185 implements of obsidian and jasper, arrow-points, knives, and flakes, from Lassen County (22672); collection of arrow-heads, pipe, leaf-shaped implement, scraper or knife of chalcedony, nine leaf-shaped implements of obsidian, arrow-points of obsidian, leaf-shaped implements of obsidian and jasper, and specimens of fossil plants found on the divide between Moonlight and Light's Cañons (23214).

**Frey**, S. L. (Palatine Bridge, New York). Collection of mammal bones and stone implements from prehistoric Mohawk villages (purchase). 23202.

**Fry**, F. H. G. (New Orleans, Louisiana). Ornaments and masks from Amazonian figures. 22738.

**Fuchs & Lang** (New York City). Catalogues and circulars. 22555.

**Gaddis**, **John** J. (New Washington, Ohio). Perforated boat-shaped object of banded slate. 23159.

**Gaddis**, T. S. (Baltimore, Maryland). Baldhead Tumbler-pigeon. 22932.

**Gale**, **Denis** (Gold Hill, Colorado). Birds' eggs and nests. 22575.

**Galloway**, C. D., Jr. (Urbana, Maryland). Specimen of Helmet Beetle or Tortoise-shell Beetle (*Coptocycla guttata*). 22289.

**Gambrill**, C. A. (See under Sandy Point Ducking Club.)

**Gardiner**, Rev. F., Jr. (Pomfret, Connecticut). Basket, game (Wa-wee), tambourine, violin, and case from the Barbadoes (22998); alcoholic specimens of fishes (22957).

**Garner**, R. L. (Mathews Court House, Virginia). Adze, from the Fiji Islands, grooved ax (prehistoric stone implement) from Gynn's Island, Virginia, vertebra of whale from Pianatank River; petrified ribs of whale from Iron Point; petrified whale and coral found in shell under a stratum of iron, barnacle, miocene fossil, shells from Iron Point, and iron ore (22295); stone implement (22468); upper and lower pharyngeal teeth of a drumfish *Pogo chromis* (22772).

**Garrison**, F. L. (Philadelphia, Pennsylvania). Sheet iron coated with (sulphide of lead)? by a new process. 22313.

**Gatschet**, Dr. **Albert** S. (Bureau of Ethnology). Two watch chains made by Winnebago Indians of Thurston County, Nebraska, from catlinite stone. 22675.

**Gay**, **Francis** (Makaweli Kauai, Hawaiian Islands), (through Prof. H. Carrington Bolton). Specimens of fiber-yielding plants and fabrics. 23325.

**Gestro**, Prof. R. (Genoa, Italy). Fourteen species of blind Coleoptera from the Mediterranean countries (exchange). 22223.

**Gerrard**, E. (Camden Town, N. W. London, England). Skin of *Felis yaguarondi* from British Guiana. 22630.

**Gibbons**, Mrs. M. A. (District of Columbia). Specimen of iron ore from Michigan. 23044.

**Gilbert**, G. K. (See under Interior Department, U. S. Geological Survey.)

**Gilman**, Z. D. (Washington, District of Columbia). Specimen of Bald Eagle (*Haliæetus leucocephalus*), in the flesh from Prince George County, Maryland. 22899.

**Gillian**, Rev. J. D. (Beaver Seminary, Beaver City, Utah). Awl made of bone taken from a mound. 22898.

**Gillinwater**, Miss (Washington, District of Columbia). Living specimen of alligator. 22619.

**Glaser**, **Peter** (Reading, Pennsylvania). Specimens of stones from Neversink Mountain, Berks County. 22267.

**Gleason**, **James** M. (Boston, Massachusetts). Duplicate bronze medals in commemoration of the visit of the Boston Commandery to the 24th Triennial Conclave, 1889. 22430.

**Gleeson**, Dr. J. A. P. (Washington, District of Columbia). Living specimen of Crowned Horned Lizard (*Phrynosoma coronatum*) from California. 22206.

**Glover**, Rev. A. K. (Grand Haven, Michigan). Copper half-cents (United States), 1801 and 1826; seven copper cents, 1793, 1794 (two specimens), 1795, 1796, 1797, 1798, and two pattern cents of 1783 and 1784. 23149.

**Golden**, Mrs. L. C. (Chaptico, Maryland). Living specimen of Hawk (*Buteo borealis*). 22227.

**Golden**, R. A. (Washington, District of Columbia). Skull of *Elactate canada*. 22246.

**Goldsmith**, J. S. (U. S. National Museum). Specimen of Bruner Isabel Pigmy Pouter-pigeon, in flesh. 22688.

**Goode**, Dr. G. **Brown** (Assistant Secretary, Smithsonian Institution). Book in the Fiji language, printed in 1847, at Viwa (22616); single-combed white Leghorn fowl, in flesh, for mounting (22636); collection of specimen numbers of old or curious journals and periodicals (22640); copy of "Western Art Journals," published at Cincinnati, Ohio, January, 1855, vol. I, No. 1 (22710); description and plates of the Ramsden Dividing Engine, published in London (23071). (See under Wesleyan University.)

**Goode**, Mrs. G. **Brown** (Lanier Heights, Washington, District of Columbia). Twelve living domestic fowls as follows: Pair of single-comb White Leghorns; pair of Black Minorcas; pair of Langshans; pair of White Minorcas, and four Black-breasted Red Games (22291); one silver-spangled Hamburg chicken (22314).

**Goodwin**, Dr. F. H. (Tucson, Arizona). Specimens of "Canaigre," said to be the root of *Rumex hymenosepalum*, a tanning material. 22595.

**Graf**, **Theodor** (Vienna, Austria). Thirty-four heliogravures and 95 photographs of ancient Egyptian encaustic paintings. 22841.

**Grand Commandery, Knights Templar**, of State of Nebraska (through DeWitt C. Sutphen, Omaha, Nebraska). Banner of the Grand Commandery of Knights Templar of the State of Nebraska, carried in the grand parade of the Triennial Conclave, held at Washington, District of Columbia, October, 1889. 22449.

**Grant**, **Isaac** M. (Ellsworth, Maine). Builder's model of schooners and bark. 22656. (See under W. H. Abbott.)

**Greegor**, **Isaiah** (Jacksonville, Florida). Fourteen species of marine shells, from the West Indies and Florida (22474, 22604); a series of *Cassis flammea* and *Oliva literata* (22604); collection of fresh-water shells from McCoy's Creek, near Jacksonville, Florida, and marine shells from Abaco (22767); 26 specimens of marine shells, polished, and in sections (22866).

**Green**, **William** J. (Washington, District of Columbia). Two binding-posts, used on secondary coil by Professor Henry in experimental work; two dip-needles, used by him, and one coil of No. 8 insulated copper wire, supposed to have been imported by him from Paris, and one magnet. 23283.

**Greenleaf**, Hon. **Eugene** (Bath, Maine). Twenty-three photographs of ships and ship-building (23157); four photographs of marine engines built at Bath (23297).

**Greey**, Mrs. E. M. (New York). Four sets of Japanese paper stensils. 23099.

**Griffin**, Miss **Maggie** (Smithsonian Institution.) Astral lamp from Orange County, Virginia, supposed to be a Jeffersonian relic. 23117.

**Griffing**, **Charles** M. (Shelter Island, New York). Light Brahma chicken and eggs (23021); pair of light Brahma fowls (23011).

**Griffing**, **Moses** B. (Shelter Island, New York). Sixteen eggs of *Pandion haliaëtus carolinensis*. 23233.

**Griggs**, J. M. (Brooklyn, New York). Specimens of marine and land-shells from the Gaboon River, West Africa. 22403.

**Grinnell**, **George Bird** (New York City). Skin of Mountain Goat juv. (*Mazama montana*), from St. Mary's Lakes, Montana (22263); 4 skins of mountain goat, from British Columbia, collected by the donor (22727).

**Guildhall Library Committee** (through Mr. Charles Welch, London, England). Fourteen copies of bronze medals issued by the corporation of London: The opening of the new Coal Exchange, 1849; Visit of Napoleon III and Eugenie, April

Guildhall Library Committee—Continued.
19, 1855; visit of King Victor Emanuel, December 4, 1855; welcome to Abdulaziz Othomanorum Imperator, 1867; Holborn Viaduct and Black-friars Bridge, 1869; visit of Shah of Persia, June 20, 1873; visit of Alexander II, Emperor of Russia, 1874; visit of George I, King of Greece, 1880; opening to the public of Epping Forest, May 1882; opening of the new council chambers of the Guildhall, October 2, 1884; visit of Prince Albert Victor of Wales, June 29, 1885; visit of the Colonial and Indian representatives, June 25, 1886; jubilee of the reign of Queen Victoria, June 21, 1887. 23093.

Gundlach, Dr. Juan (Havana, Cuba). Nine species of birds' skins. 22964.

Gutekuntz, F. (Philadelphia, Pennsylvania). Two books of photographs, with separate plate and duplicate. 23213.

Hagen, Dr. I. (Trondhjem, Norway). Three hundred and twenty species of Norwegian mosses (exchange). 23323.

Haley, William M. (San Francisco, California). German Bible printed in Halle in 1765, and German passport issued to K. Land in May, 1837. 23151.

Hall, Mrs. Charlotte (Prescott, Arizona). Obsidian arrow-point dug from a ruin. 23251.

Hall, William (Winnepeg, Manitoba). Templar badge and card from the Knights Templar Conclave held at Washington, District of Columbia, October, 1889. 22432.

Hamill, G. D. (Georgetown, New Mexico). Specimens of descloizite and vanadinite from the "Commercial" mine (collected by Dr. W. F. Hillebrand of the U. S. Geological Survey). 22543.

Hancock, Dr. Joseph L. (Chicago, Illinois). Living specimen of snake from Aspinwall, South America, taken from a bunch of bananas around which it was coiled (23337); fourteen specimens, representing fourteen species of birds' skins (22921).

Hancock, Mrs. W. S. (Washington, District of Columbia). Cane presented to Gen. Winfield Scott Hancock in 1884 by the citizens of Brooklyn, New York; sword voted to the general at the sanitary fair held at St. Louis, Missouri, in 1884, and one regulation sword carried by him throughout the war of 1860–'65. 22425.

Handy, Rev. James A. (Washington, District of Columbia). Specimen of red carrier-pigeon (23022); specimen of Blue-rock carrier pigeon in flesh (23336).

Hargrave, C. A. (President of the Central Normal College, Danville, Indiana). Specimens of land and fresh-water shells from Hendricks County. 22686.

Harkness, Henry (U. S. National Museum). Living specimen of Scorpions (*Centurus vittatus*). 22967.

Harlan, A. W. (Croton, Iowa). Tufts of a flowering plant, and package of seed. 22415.

Hardy, Manly (Brewer, Maine). Two eggs of *Buteo lattissimus* (23265), nest and 6 eggs of *Regulus calendula* (23291).

Harney, Mrs. Mary E. (District of Columbia). Mexican saddle and harness, chappeau, military cap, epaulettes, revolvers, and two rifles, personal relics of the late Gen. W. S. Harney. 22920.

Harper, G. W. F. (Lenoir, North Carolina). Specimen of curled Yellow Poplar (*Liriodendron tulipfera*) from Caldwell County. 22292.

Harris, E. Allen (Washington, District of Columbia). Opossum from Virginia. 22939.

Harris, Gwynn (Washington, District of Columbia). Specimens of fishes *Trichiurus lepturus* and *Selene vomer* from Piney Point, Maryland (22329); specimen of Whistling Swan (*Olor columbianus*) from Maryland Point, Potomac River (23051).

Harrison, Hon. Benjamin (President, Executive Mansion). Specimen of Racoon (*Procyon lotor*). 23059.

Harrison, E. M. (U. S. Geological Survey). Specimen of steatite from near Hunter's Mills, Virginia (22564); specimen of talc (collected by E. L. Howard) (22576).

Hart, J. H. (Botanic Garden, Trinidad, West Indies). Two alcoholic specimens of *Eupemphyx trinitatis*. 22269.

Harvard University, Library of (Cambridge, Massachusetts). A bibliography of William Hogarth, by Frank Weitenkampf.

Harvey, Prof. F. L (See under Maine State College.)

Harvey, George E. (Washington, District of Columbia). Living specimen of Spiny Soft-shelled Turtle (*Aspidonectes spinifer*) from Louisiana. 22205.

Haupt, Prof. Paul (John Hopkins University, Baltimore, Maryland). Clay tablet containing an Assyrian poem composed by the donor for the Eighth International Congress of Trientalists. 22634.

Hawkins, Willis B. (Washington, District of Columbia). Living specimen of alligator. 22550.

Hayden, Emma W. (Philadelphia, Pennsylvania). Crayon portrait (framed) of the late Dr. T. V. Hayden. 22832.

Hayward, B. M. (Weybridge, Vermont). Twelve specimens, representing 10 species of birds' skins from Monterey, Mexico (exchange). 22222.

Hayward, R. S. (Coronado, Kansas). Specimen of White-tailed Jack-rabbit (*Lepus campestris*), Black-tailed Jack-rabbit (*Lepus callotis*), and Cotton-tail rabbits (*Lepus sylvaticus*). 23083.

Hazen, Henry H. (Washington, District of Columbia). Living specimen of Gray Squirrel (*Sciurus carolinensis carolinensis.*) 22622.

Healy, Capt. M. A. (U. S. Revenue Marine steamer *Bear*), (through the Alaska Commercial Company). Eighty-nine photographs of Alaska. 23141.

Heliotype Printing Company (Boston, Massachusetts). Specimens of half-tone photolithographic work executed in the establishment of the donors. 22512.

Hemphill, Henry (San Diego, California). Series of chitons, from the lower coast of California (23023); specimens of marine shells (23034); specimens of tertiary fossils and marine shells from Lower California, fresh-water shells from Oregon, and specimen of Sea-urchin (*Lovenia cordiformis*) (23102).

Hendricks, Ralph M. (Washington, District of Columbia). Living specimen of Cooper's Hawk (*Accipiter cooperi*). 23088.

Henry, W. G. (U. S. Coast and Geodetic Survey steamer *Blake*). Specimen of *Pseudospinx tetrio* from the Gulf of Mexico. 22834.

Henshaw, H. W. (U. S. Geological Survey). Collection of fishes from the vicinity of Washington, District of Columbia, representing the following species: *Perca, Amiurus, Notropis, Rhinichthys, Hybopsis, Notemigonus, Fundulus, and Enneacanthus* (22301), stone paddle (22470).

Herberson, John W. (Colesville, Maryland). Specimen of Bob-white (*Colinus virginianus*). 23075.

Herberson, William A. (Colesville, Maryland). Specimen of Musk-rat (*Fiber zibethicus*). 23153.

Heurich, Christopher (Washington, District of Columbia). Specimens of ground malt; whole malt from Canada and the United States; patent malt from Germany; imported hops; isinglass, and beech-wood for clearing beer. 22704.

Hewitt, J. N. B. (Bureau of Ethnology). Collection of ethnological objects, consisting of Iroquois pump fire-drill, stick for rubbing out fire, packs for carrying provisions, skins, etc., from Grand River Reservation, Canada, Onandagua Indians (exchange). 23028.

Hidden, W. E. (Newark, New Jersey). Specimens of Muscovite crystals coated with hisingerite; dolomite and muscovite crystals coated with hisingerite and dolomite, and dolomite, muscovite, and rutile crystals (collected by Mr. W. S. Yeates, of the U. S. National Museum). 23162.

Hill, Prof. R. T. (State University, Austin, Texas). Fragment of meteoric stone. 22341.

HILLEBRAND, Dr. W. F. (U. S. Geological Survey). Thirty-eight specimens of vanadinite from Yuma County, Arizona (22483); 3 specimens of descloizite and vanadinite from the "Commercial" mine, Georgetown, New Mexico (22539); piece of tapa from the Hawaiian Islands, and native plaited rope (22638); 7 specimens of chemical elements, all products of original research by the donor (23026). See also under Alexander McGregor; G. D. Hamill; John C. White; Interior Department; Judge W. H. Barnes; J. A. Lucas; C. J. Luff & Company; Dr. J. E. Wharton; W. H. Bentz; Ed. Clark.

HINKLEY, A. A. (Dubois, Illinois). Specimens of Unio and Pleurocera. 23109.

HISLOP, Dr. M. (District of Columbia). Specimens of red sandstone from north of Pugwash, Nova Scotia. 22908.

HITCHCOCK, ROMYN (U. S. National Museum). Collection illustrating Japanese life from Japan (purchase) (21640); specimens of marine shells from the east coast of Japan; specimen of bat *Vesperugo abramus;* insects from Ozaka, Japan; collection of sponges, echini, barnacles, and a gorgonian (22392); collection of Aino articles from Yezo, Japan, and specimens of sulphur collected from the active volcano Iwo-san at Yezo; botanical specimens from the islands of Yezo, Shikotan, and Yeterof (Iterup) (22393); biwa, or balloon guitar from Ozaka, Japan (purchase) (22518).

HOBGOOD, JOHN H. (Washington, District of Columbia). Living Horned Owl (*Bubo virginianus*). 22276.

HODGE, E. B. (Plymouth, New Hampshire). Two fresh specimens of Trout (*Salvelinus aurelis*). 22571.

HODGE, H. G. (York, Illinois). Specimens of fresh-water pearls from *Unios* from the Wabash River (22339); fragments of mound pottery, Unios, and other fresh-water shells, quartz geode, and samples of gravel (22409); specimen of crawfish from the Wabash River (23017).

HODGES, F. W. (Bureau of Ethnology). Kicking-block, used in Zuñi game or "Race for Rain." 23236.

HODGKIN, Dr. J. B. (Washington, District of Columbia). Slungshot, carried by a negro in Virginia. 23185.

HOGAN, J. J. (Washington, District of Columbia). Piece of broken glass with oysters attached from Chesapeake Bay. 22763.

HOLBROOK, E. L. (New York City). Jewish lamp. 22335.

HOOVER, A. M. (District of Columbia). Specimen of *Scolopendro heros* from Fort Sill, Indian Territory. 23007.

HOPKINS, C. L. (Department of Agriculture). Specimens of fossil mollusks and fossil Echinus from Texas. 22674.

HORAN, HENRY (U. S. National Museum). Specimen of *Rhagium lineatum*, with hibernating nest (22764); skin of Pangolin (*Manis longicaudata*) (22790).

HORNADAY, WILLIAM T. (Smithsonian Institution). Woodchuck (*Arctomys monax*) from Rosslyn, Virginia (22273); Red Fox (*Vulpes fulvus fulvus*) from the District of Columbia (22317); model of a Dyak house at Sadong, North Borneo (deposit) (22676); mountain sheep, representing different stages in life (22728); three specimens of selenite from Corbett, Wyoming (22858); plaster bust of Prof. T. H. Huxley (exchange), (23310).

HOUGH, FRED. C. (Morgantown, West Virginia). Specimen of Robber Wasp (*Stizus speciosus*). 22281.

HOWARD, ERNEST (U. S. Geological Survey). Specimens of hematite from Herndon, Virginia. 22465.

HOWARD, E. L. (U. S. Geological Survey). Specimens of azurite, malachite, and hematite from Herndon, Virginia. 23256. (See under E. M. Harrison.)

HOWARD, HOUGH (Washington, District of Columbia). Opossum from Virginia. 22756.

HOWARD, L. O. (Department of Agriculture). Specimen of Tusser silkworm hatched from cocoon sent from India to the U. S. National Museum by Mrs. Scott. 22236.

HOWARD, R. S. (Coronada, Kansas). Specimens of Swifts or Kit-foxes (*Vulpes velox*). 22988.

HOXIE, WALTER. (See under Dr. Allen Stuart.)

HOXTON, A. R. (Episcopal High School, Alexandria, Virginia). Living specimen of Red-tailed Hawk. 22642.

HUDDLESON, N. (Crainesville, Tennessee). Fragments of pottery, stone implement, fossil shells, fossil bone, flint chips, and mammal teeth from near Bolivar (collected by Mr. L. C. Johnson). 22184.

HUGGINS, Judge (Gillsborough, Ohio), (through Mr. D. L. James). Specimen of *Cyrtoceras* sp., from the Niagara group of Highland County. 23121.

HUNT, A. E. (See under Pittsburg Reduction Company.)

HUNT, Masters DICK and HARRY DRUM (Bethesda, Maryland). Two living specimens of Sulphur-crested Cockatoos (*Cacatua galerita.*) 23106.

HUNTER, W. M. (Accotink, Virginia). Spear-head found near Woodlawn, Fairfax County. 22310.

HUNTINGTON, Prof. J. H. (Silver City, Arizona). Specimen of infusorial earth from Gila River (22893); gold-bearing rock from Santa Fé County (23035).

HURTER, JULIUS (St. Louis, Missouri). Specimens of *Tropidonotus rhombifer*, *Tropidoclonium lineatum*, *Eutænia faireye*, *Diemyctylus miniatus viridescens*, *Bufo lentiginosus americanus* (23126, 23335).

HUTCHINSON, K. M. (Oshkosh, Wisconsin), (through Prof. J. F. James). Specimen of *Pentamerus oblongus* Sow., from the Niagara formation of the Upper Silurian, at Clifton Heights, Lake Winnebago (22482); specimen of silver ore from Lake Superior Silver Mine (23115).

HYVERNAT, Prof. H. (Catholic University, Washington, District of Columbia). Eighteen oriental seals; (23332); Assyrian and Babylonian seal cylinders, gems, and Egyptian scarbæi (22717).

INGERSOLL, A. M. (San Diego, California). Nest and eggs of *Ammodramus beldingi*, new to the collection. 22768.

INSETSU KIOKU, The Finance Department (Tokio, Japan), (through T. Tokuno, chief of the Insetsu-Kioku). Samples of Japanese woodcuts, printing, engraving, and engraving tools (exchange). 22582.

INTERIOR DEPARTMENT (through Hon. John W. Noble, Secretary).

Ethnological specimens and objects of handiwork, from the Snohomish, Swinomish, Lummi, Muckleshoot, and Etakmur Indians on the Tulalip Reservation, Washington (collected by Mr. E. C. Chirouse, United States agent in charge of the reservation) (22496).

U. S. GEOLOGICAL SURVEY (through Maj. J. W. Powell, Director).

Living snakes (collected by Mr. George W. Shutt). 22186.

Type specimen of *Conocoryphe reticulata*, Walcott from the Lower Cambrian, New York. 22446.

Thirty specimens of minerals comprising miloschite, rhodochrosite, bournonite, barite, siderite, adularia, pyrargyrite, amethyst, chabazite, sodalite, nagyagite, alunite. 22487.

Specimen of thinolite, from Lake Lahontan, Nevada. 22547.

Specimens of fresh-water fossils, from the post pliocene deposits from Bonneville and Lahontan beds, and specimens of fossils from Nevada. 22564.

Miscellaneous collection of geological materials from Madison county, Montana. 22868.

Twenty-one transparencies. 22891.

Copies of two models of Mount Shasta, California. 23160.

Collections of the quicksilver investigations of the Pacific slope, made by Dr. G. F. Becker. 22978.

INTERIOR DEPARTMENT—Continued.

*Collected by Prof. F. W. Clarke:*

Seven specimen of graphite in calcite, specimen of pyrite crystal, specimen of calcite, specimen of magnetite from Port Henry and Mineville, New York. 22344.

*Collected by Mr. George W. Cook:*

Specimen of selenite from Fort Washington, Maryland. 22544.

*Collected by Dr. William H. Dall:*

Specimens of fossil plants from Alum Bluff, Florida. 22365.

Collected by Prof. S. F. Emmons:

Specimen of alunite from the Brooklyn tunnel, Red Mountain district, San Juan, Colorado. 22364.

*Collected by Mr. G. K. Gilbert:*

Six slabs of stone exhibiting glacial striæ, the two from Canada collected by Mr. Gilbert, and the others by President T. C. Chamberlin. 22528.

*Collected by Dr. W. F. Hillebrand:*

Specimens of vanadinite and wulfenite, from the Old Yuma Mine, Arizona. (22599.)

Specimen of wulfenite from the Red Cloud Mine, Arizona. (22605.)

Specimens of vanadinite from Aqua Fria Mine, Yavapai County, Arizona. (22826.)

Sixty-four specimens of vanadinite from the Hamburg Mine, Silver district, Arizona, and 43 specimens of vanadinite from the Clara Mine in the same district. (22827.)

Specimen of Iodorite from the Old Man Mine, near Silver City, New Mexico. (22848.)

Two hundred and sixty specimens of malachite, azurite, cuprite, calcite crystals and stalactite from the Copper Queen Mine, at Bisbee, Arizona. (22897.)

*Collected by Mr. W. P. Jenney:*

Thirteen specimens of calcite, smithsonite, greenockite, barite, chalcopyrite, and sphalerite. 23186.

Through Mr. W. J. McGee:

Two specimens of kyanite from Delaware County, Virginia, and one specimen of anthophyllite, and one specimen of iridescent limonite from Cuba. 22464.

*Collected by Mr. C. D. Walcott:*

Specimen of wulfenite, from Éureka, Nevada. (22363).

Specimens of wulfenite and cerussite, from the Richmond Mine, Nevada. (22563).

Twenty-six specimens, representing 7 genera and 8 species of fossils of Lower Cambrian and Ordovician System.

Lower Cambrian: Annelid trails, *Kutorgina pannula* White, *Hyolithes americanus* Billings, *Isoxys chilhoweana* Walcott (Type sp)., *Olenellus* sp?, *Olenoides ellsi* Walcott (Type sp.).

Ordovician System:* *Conotreta rusti* Walcott, (Type sp.) (22609).

Two hundred and eighty-seven specimens, representing 24 genera and 32 species of fossils of Lower Cambrian, Ordovician, and Silurian (22847).

Nine specimens of *Lingulepis morsensis* and two specimens of *Planolites* sp., from the Trenton group, Fountain, Minnesota; specimen of *Receptaculites oweni*, from Trenton group, Ripon, Wisconsin (23138).

Five hundred and twenty-six specimens, representing 56 genera and 94 species, as follows:

Lower Cambrian: *Obolella crassa* Hall, *Obolella* sp.?, *Kutorgina labradorica* var. *swantonensis* Walcott, *Orthisina transversa* Walcott, *Scenella* sp. ?, *Hyolithes*

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*See Proceedings of the National Museum, vol. XII, p. 365, 366.

**Interior Department**—Continued.

*americanus* Billings, *Stenotheca rugosa* Hall, *Olenellus* sp.?, *Olenoides ellsi* Walcott, *Olenoides marcoui* Whitfield, *Zacanthoides eatoni* Walcott, *Microdiscus connexus* Walcott, *Ptychoparia* sp. ?, 11 genera and 12 species.

Lorraine formation of Ordovician: Mud markings, *Bilobites* sp. ?, *Dendrograptus simplex* Walcott, *Monticulipora mammillata* D'Orbigny, *Monticulipora discoidea* Nicholson, *Monticulipora* sp., undet., *Heterocrinus heterodactylus* Hall, *Glyptocrinus decadactylus* Hall, *Cornulites incurvus* Shumard, *Hippothoa inflata* Hall(?) *Serpulites dissolutis* Billings, Annelid trails, *Ptylodictya* sp., *Palechara* sp.? *Lingula æqualis* Hall ?, *Lingula quadrata* Eichwald, *Trematis terminalis* Conrad, *Crania* sp. ?, *Pholidops subtruncata* Hall, *Pholidops truncata* Hall, *Strophomena tenuistriata* Sowerby, *Strophomena alternata* Conrad, *Strophomena alternata* var. *nasuta* Conrad, *Leptæna sericea* Sowerby, *Streptorhynchus* sp. ?, *Orthis testudinaria* Dalman, *Orthis erratica* Hall, *Orthis occidentalis* Hall, *Orthis emacerata* Hall (?), *Orthis biforata* Schlotheim, *Orthis* sp. undet., *Zygospira modesta* Say, *Avicula insueta* Conrad, *Pterinea demissa* Conrad, *Ambonychia radiata* Hall, *Nucula levata* Hall, *Cleidophorus plannulatus* Conrad, *Lyrodesma poststriatum* Emmons, *Lyrodesma pulchellum* Hall, *Lyrodesma* (?) sp. ?, *Modiolopsis anodontoides* Conrad, *Modiolopsis faba* Conrad, *Modiolopsis modiolaris* Conrad, *Modiolopsis cancellata* Walcott, *Modiolopsis curta* Hall, *Modiolopsis pholadiformis* Hall, *Modiolopsis truncata* Hall, *Modiolopsis nasuta* Conrad, *Modiolopsis* sp. undet., *Orthonota parallela* Hall, *Orthodesma contractum* Hall, *Cyrtolites ornatus* Conrad, *Bellerophon bilobatus* Sowerby, *Bellerophon cancellatus* Hall, *Carinaropsis patelliformis* Hall, *Raphistoma lenticulare* Emmons, *Raphistoma* sp. undet., *Pleurotomaria tropidophora* Meek, *Pleurotomaria subconica* Hall, *Pleurotomaria* sp. undet., *Murchisonia milleri* Hall, *Murchisonia bellicincta* Hall, *Murchisonia uniangilata* var. *abbreviata* Hall, *Murchisonia* sp. undet., *Conularia* sp.?, *Orthoceras corralliferum* Hall, *Orthoceras* sp. undet., *Endoceras proteiforme* Hall, *Plumulites jamesi* Hall, *Beyrichia* sp. undet., *Trinucleus concentricus* Eaton, *Triarthrus becki* Green, *Calymene callicephala* Green, *Asaphus platycephalus* Stokes, *Asaphus* sp. undet., *Acidaspis*. Unidentified 45 genera and 76 species. (22730).

Specimen of sandstone with mud and ripple marks, from Grand Cañon group, 7,000 feet below the base of Cambrian, Grand Cañon of Colorado, Arizona (22741).

**Office of Indian Affairs** (through Hon. T. J. Morgan, Commissioner) Wooden hoe from the Indians of the Chippewa Reservation.

**Interior Department of Ottawa, Canada** (Secretary's Branch), (through Lyndwoode Pereira, assistant secretary.) Map of Manitoba and the northwest territories, showing the land districts in that part of the dominion, and a map showing the dominion lands in the railway belt in British Columbia. 22793.

**Jackson**, Mrs. A. C. (District of Columbia). Collection of ethnological objects from the Indians of Dakota. 22913.

**Jacobs**, C. P. (Indianapolis, Indiana). Mementos of the funeral of President Lincoln. 22729.

**Jacobs**, F. O. (Newark, Ohio). Cast of stone with sculptured head of an animal, taken from a mound (23047); microscopic slides of Aztec textile fabrics (23110).

**Jaisohn, Phillip** (Army Medical Museum, Washington, District of Columbia). Japanese twenty sen piece (silver). 22200.

**James**, D. L. (through Prof. Joseph L. James, of the U. S. Geological Survey). Two specimens of *Scaphiocrinus macrodactylus* M and W, from the Lower Carboniferous shales, Martin County, Indiana (22442); slabs with polyzoa, crinoid, and corals from the same region (23120).

**James**, Prof. **Joseph** F. (U. S. Geological Survey). Fifty specimens, representing ten genera, and sixteen species of fossils from the Cincinnati formation of the Lower Silurian, consisting of *Palæophyllum divaricans*, *Streptelasma corniculum* Hall, *Monticulipora briarea*, *Monticulipora delicatula* Nicholson, *Monticulipora*

JAMES, Prof. JOSEPH F.—Continued.
*onealli* James, *Monticulipora mammilatak*, *Protarea vetusta*, *Strophomena alternata* Conrad, *Orthis jugosa* James, *Orthis biforata* Schlotheim, *Ambonychia radiata* Hall, *Ambonychia bellistriata* Hall, *Calymene callicephala* Green, *Saaphus platycephalus* Stokes. 22602. (See under D. L. James, A. R. Crandall, K. M. Hutchinson, W. H. Adams.)

JAMES, STEPHEN (Washington, District of Columbia). Carrying-net, made by the Mission Indians of California. 22610.

JAMMES, L. H. (Realmont Tarn, Southwest France). Collection of stone implements from Cambodia. 23024.

JENNEY, W. P. (U. S. Geological Survey). Three specimens of marbles, from Sugar Orchard Creek, Boone County, Arkansas. 23139. (See under Interior Department U. S. Geological Survey.)

JOHNS, H. W. (See under H. W. Johns Manufacturing Company.)

JOHNS, H. W. Manufacturing Company (New York City). Specimens of fiber of asbestus from Wyoming and Africa (22358); samples of asbestus and specimens manufactured from the same material (22333).

JOHNSON, CHARLES ENEW & Co. (Philadelphia, Pennsylvania). Specimens of the materials used in making ink for printing woodcuts. 22521.

JOHNSON, LEWIS, & Co. (Washington, District of Columbia). Hungarian paper money, ten notes of 10 florins each, issued at Buda-Pesth, September 1, 1848. 22777.

JOHNSON, LOUIS B. (See under R. D. Wimsatt.)

JOHNSON, L. C. (See under N. Huddleson.)

JOHNSON, Prof. O. B. (University of Washington, Seattle, Washington). Specimens of *Terebratella transversa* and other mollusks, from Puget Sound; alcoholic specimens of reptiles consisting of *Eutænia cooperi*, *Eutænia* sp., *Sceloporus occidentalis*, *Amblystoma*, and *Eumeces skiltonianus* from Washington and Oregon; alcoholic specimens of fishes, consisting of *Gobiesox reticulatus*, red salmon, *Nauthichys*, *Zaniolepis*, *Oxylebius pictus*, *Blepsias*, *Salvelinus malma*. *Xiphister chirus* and *Cottus* from Seattle, Washington; specimens of crustacea, tunicata, echinodermata and pennatula. 23321.

JONES, JAMES T. (Washington, District of Columbia). Double-crested Cormorant (*Phalacrocorax dilophus*) from Mount Vernon flats, Virginia. 22873.

JOUETT, JAMES E. (Sandy Spring, Maryland). Larva of a heterocampa parasitized by an Ichneumonia. 22348.

JOUY, P. L. (U. S. National Museum). Ten specimens, representing 4 species of land, fresh-water, and marine shells from Corea (22561); specimen of garnet gravel from the Kimberly Diamond Mines, South Africa (23269).

JOYNES, R. C. (See under Life Saving Service, Treasury Department, U. S.)

JUENGLING, FRED (New York City). Original wood-block electrotype and proof of an intaglio engraving on wood "The Smoker," after Muhrman, engraved by the donor. 22510.

KANTROWITZ, J. H. (New York). Three photographs of ancient Jewish scholars. 22338.

KASSON, JOHN A. (Washington, District of Columbia). A musical instrument known as a "Guzlar," made by the peasants in Montenegro and Herzegovina, and used by them to accompany songs about their horses and fights against the Turks. 22687.

KEELER, CHARLES A. (Carson City, Nevada). Eggs and nests of *Zamelodia melanocephala*, *Columba fasciata*, *Oroscoptes montanus*, *Spizella breweri*, *Zonotrichia leucophrys*, *Merula migratoria propinqua*. 22215.

KEEP, Prof. J. (Mills College P. O., California). Specimen of *Periploma discus* (exchange). 23136.

KEITH, B. F. (Boston, Massachusetts). Rigged model of a ship made by an invalid seaman. 22786.

**KEMP**, Prof. J. F. (Cornell University, Ithaca, New York). Three specimens of eruptive rocks. 22486.

**KENNEDY**, I. M. (Alberton, Maryland). Specimen of Copperhead (*Agkistrodon contortrix*). 23262.

**KENNEDY**, J. (Lubec, Maine). Builder's model of schooner. 22649. (See under W. H. Abbott.)

**KEPPEL**, F., & Co. (New York City). Three prints by H. Eichens, pure mezzotint, etched preparation for mezzotinting, and etching finished in mezzotint (22417); picture, "Peasant Boy," by Henry Guicard (23279).

**KESSLER**, C. W. (Statesville, North Carolina). Two hundred and forty-three specimens of corundum and its alterations. 22265.

**KIDWELL, HARRY** (Washington, District of Columbia). Black Magpie Pigeon in flesh. 22402.

**KILBOURNE**, Dr. F. L. (United States Veterinary Experiment Station, Benning's Road, Washington, District of Columbia). Pair of living Angora Guinea pigs (*Cavia aperia*). 22938.

**KIMBERLEY**, Rear-Admiral L. A. (See under Navy Department, U. S.)

**KIMMEL & VOIGT** (New York City). Four impressions from a dry ground aquatint plate, each printed differently, with several duplicates. 23278.

**KLINGES**, J. P. (Philadelphia, Pennsylvania). Collection of 5-cent postage stamps of the Confederate States. 22968.

**KLOSS**, Maj. **KARL**. (See under Government of Switzerland.)

**KNAPP, EDWARD** (Fabins, New York). Silver Wyandotte chicken. 22934.

**KNOWLTON**, F. H. (U. S. Geological Survey). Two specimens, representing 2 species of birds' skins from California (22594); specimens of manganese ores from Brandon, Vermont (23312).

**KNOWLTON**, W. S. (Boston, Massachusetts). Specimen of gold in quartz from Grass Valley, California. 22343.

**KNOX**, Mrs. **NETTIE** M. (National Homeopathic Hospital, Washington, District of Columbia). Specimen of Gray Squirrel (*Sciurus carolinensis carolinensis*). 22878.

**KNUDSEN, VALDEMAR** (Waiawa, Hawaiian Islands). Forty-eight specimens, representing 20 species of birds' skins from the Sandwich Islands (22237); 2 birds' skins, and 2 specimens of Bulwer's Petrel (*Bulweria bulweri*) the first specimens obtained from the Pacific Ocean (22520).

**KOBER**, Dr. **GEORGE** M. (Washington, District of Columbia). Nez Percé Indian costume from Idaho; specimen of Yuma pottery from Arizona; pipes and basket from Washington, spoon and ivory box from Alaska, and various specimens from Spokane, Cœur d'Alene, and other Indians. 22761.

**KOCH, JOHAN BUNTZEN** (Bozeman, Montana). Two flint hatchets, from the Island of Laaland, Denmark, one from a dolmen of the Island of Falster, and a polished ax from Sweden (exchange). 23190.

**KOEBELE**, A. (See under Department of Agriculture.)

**KOEHLER**, Miss **HEDWIG** J. (Roxbury, Massachusetts). Two psaligraphic pictures. 22494.

**KOEHLER**, S. R. (Roxbury, Massachusetts). Dabber for printing intaglio plates and a burnisher for taking hand proofs of wood engravings (22513); 37 etchings and wood engravings; 1 small composition roller for woodcut printing (22514); daguerreotype outfit (22954).

**KOENIG, GODFREY** (Sassin, Washington). Nests and eggs of *Turdis aonalaschkæ*, *Geothlypis trichas occidentalis*, *Setophaga ruticilla*, *Empidonax pusillus*, *Melospiza fasciata montana*, *Dendroica æstiva*, and *Turdus fuscescens salicicolus* (22373, 23311).

**KOHN, GUSTAVE** (New Orleans, Louisiana). Fourteen living specimens of *Gnathodon cuneatus* from Lake Ponchartrain (22915); 17 specimens of *Gnathodon cuneatus*, and 13 specimens of *Purpura fluvidanus* from Barataria Bay, Louisiana (22960).

**KUNZ, GEORGE** F. (New York City). Three specimens of mineralography, with one duplicate. 22647.

Kurtz, W. (New York City). Picture, "The Dispensation of Promise and the Law," the first publication in carbon of American make, and 3 portraits in carbon representing "Painter Ortel," "Carl Hecker," and "Carl Kutscher" (21547); 6 half-tone reproductions, from paintings, drawings, and etchings (23320).

Lacoe, R. D. (Pittston, Pennsylvania). Specimen of carboniferous wood. 23049.

Lacy, H. E. (Tucson, Arizona). Specimen of calcite from the Bonanza group of mines, Quijotoa district. 22600.

Laflamme, Rev. Abbé J. C. K. (Laval University, Quebec, Canada). Slab containing *Triarthrus becki* Green, *Leptobolus insignis* Hall, *Climacograptus* sp., from the Utica formation of Upper Silurian, Beaufort, Quebec Province, Canada. 22445.

Lake, B. B. (Bryson City, North Carolina). Specimens of zoisite, rutile, and limonite pseudomorph after pyrite from Swain County. 23264.

Lamborn, Dr. Robert H. (New York City). Specimens of quartz with inclusion, and banded quartz from near Fairfax Court House, Virginia; specimen of williamsite, from Wood's Chrome Mine, Lancaster County, Pennsylvania; specimen of obsidian from the Yellowstone National Park, Wyoming; specimen of green quartz, containing gold from Arizona; specimens of amazonstone and sandstone from Media, Pennsylvania, and specimen of mussel-pearl from Absecon, New Jersey, all cut and polished (23224); specimens of turquoise, cut and uncut from Los Serillos, New Mexico (22871).

Langdale, John W. (Takoma, District of Columbia). Specimen of amphibole with calcite from Georgetown, District of Columbia. 23014.

Lanyon, Samuel (Bradford, England). Specimen of tin ore from Dolcoath Mine. 22497.

Lartegue, Dr. G. B. (Blackville, South Carolina). Specimens of tertiary fossil shells found on the banks of Turkey Creek, near Charleston. 22805.

Laspeyres, Prof. H. (Bonn, Germany). Specimen of polydymite from near Siegen. Rhineland. 22342.

Landvoigt, Edward (Washington, District of Columbia). Red-tailed Hawk (*Buteo borealis*) from Montgomery County, Maryland. 22753.

Laughlin, Miss Jennie O. (Washington, District of Columbia). Living specimen of alligator from New Orleans. 22963.

League Oliver S. (Annapolis, Maryland). Antique cross-bow taken from under the floor of an old house. 22221.

La Baron, L. F. (San Juan del Norte, Nicaragua). Alcoholic specimens of reptiles, insects and mammals. 22720.

Le Breton, Albert (Washington, District of Columbia). Series of daguerreotypes of the harbor of San Francisco in 1852-'53 (deposit). 22955.

Lechtenberg, George H. (Luzerne, Iowa). Fragments of pottery and bone found in Indian mounds. 23287.

Lee, George (Washington, District of Columbia). Two silver seabright Bantam chickens and fowl (22504, 2263); specimen of booted Fantail pigeon (22504).

Lee, Prof. Leslie A. and Thomas (U. S. Fish Commission). Collection of spears, spear-points, baskets, and other ethnological objects obtained from the Fuegian Islands. 22760.

Lee, Dr. M. F. (Columbus, Ohio). Brahma hen for skeleton. 22977.

Le Duc, J. (Englewood, Illinois). Binding-post used in binding wheat and oats from Dorchester County, Maryland. 23260.

Leggat Brothers (New York City). Reproduction (chromo-lithograph) of the Tabernacle of the Desert (purchase). 22480.

Leon, Dr. Nicolas (See under Museo Michoacano).

Lewis, George A. (Wickford, Rhode Island). Two specimens of Trigger-fish (*Balistes capriscus*) (22255); Cutlass-fish (*Trichiurus lepturus*) from Naragansett Bay (22383).

Lewis, Harry (Washington, District of Columbia). Specimen of Gray Squirrel (*Sciurus carolinensis carolinensis*). 22316.

Lewis, W. F. (Washington, District of Columbia). Specimen of American Coot (*Fulica americana*) from the Eastern Branch. 22982.

Lichtz, M. W. (West Washington, District of Columbia). Two living specimens of alligators. 22621.

Lindsay, H. A. (Asheville, North Carolina). Specimen of cut oligoclase from Mitchell County, and specimen of cut amethyst from Macon County (purchase). 22378.

Lindsay & Early (Carbondale, Pennsylvania). Original boiler of the locomotive *Stourbridge Lion*. 23316.

Linnell, Martin L. (U. S. National Museum). Collection of North American Coleoptera, containing twenty-five hundred species, and numbering about ten thousand specimens (purchase). 22705.

Litel, James E. (Albany, Wisconsin). Specimens of pearl-bearing mussels. 22451.

Lithographic Company, The H. Bencke (New York City). Ten specimens of photolithographic work executed in the establishment of the donors. 22511.

Lockett, S. H. (Jersey City, New Jersey). Skeleton of Martin (*Progne chalybea*(?)) from Carthagena, Republic of Colombia, South America. 22935.

Lofler, John (Baltimore, Maryland). Specimen of Pouter-pigeon. 22387.

Logan, Mrs. John A. (Washington, District of Columbia). Specimen of living Golden-eagle, sent in 1885, from Tennessee, as a gift to General Logan, and named by George Bancroft *Old Hickory* (deposit). 22643.

Loomis, Rev. H (Yokohama, Japan). Specimen of shells and echinoderms. 22945. Shells returned.

Loomis, Leverett M. (Chester, South Carolina). Seven specimens, representing 4 species of birds' skins (22593); 7 specimens of Prairie Horned-lark (*Otocoris alpestris praticola*) in flesh (22626); 12 specimens, representing 7 species of birds, in flesh (22666, 22733); specimen of Bronzed Grackle (*Quiscalus quiscula æneus*) (22677); 3 specimens, representing 3 species of birds, in flesh from Chester County. (22718).

Lord, Abraham (Ellsworth, Maine). Builder's model of hermaphrodite brig *Fredonia*. 22657. (See under W. H. Abbott.)

Lovett, Edward (Croyden, England). Three photographs illustrating the gun-flint manufacture at Brandon, England (exchange) (22297); 29 ethnological specimens from England, British India, and South Africa; 7 specimens of stone implements, from England, Belgium, Ireland, and Wales, and 3 photographs showing the quartering, flaking, and knapping of the flint, exchange, (22542); a porter's knot, carrying yoke and human-harness (exchange) (22569); ethnographical and archæological specimens from England, India, and Africa; paleolithic implements from Suffolk, Bedford, Dorset, and Kent, comprising fragments of Roman pottery (Samian ware), and iron implements, found in making excavations in the city of London; clay pipes, iron knives, keys, and a shoe-buckle belonging to the 16th century (also represented in the 17th and 18th centuries); a flint implement from Spiennes, Belgium (23040); 7 unfinished paleolithic implements; 5 old London relics; 16 fragments of Roman pottery; ethnological specimens from India, and obsolete specimens illustrating English lighting and cooking (23170).

Lucas, Dr. H. S. (Cullasaja, North Carolina). Specimens of chrysolite, ripidolite, vermiculite, actinolite altering to a vermiculite, and asbestus. 22886.

Lucas, J. A. (Silver City, New Mexico). Two hundred and seventeen specimens of copper pseudomorph after azurite, from the Copper Glance and Potosi copper mines, Grant County (collected by Dr. W. F. Hillebrand, of the U. S. Geological Survey). 22536.

Luff, C. J., & Co. (Georgetown, New Mexico). Specimen of descloizite and calcite from the Commercial Mine (collected by Dr. W. F. Hillebrand of the U. S. Geological Survey). 22537.

**Luscombe**, C. R. (U. S. National Museum). Model of English *Dandy Horse*, 1818, from plans prepared by the U. S. Patent Office for the New Orleans exposition (purchase). 23060.

**Luthe**, F. H. (McGregor, Iowa). Two specimens representing 2 genera and 2 species of *Acervularia davidsoni*, and 1 specimen with *Calymene* (sp.) from the Ordovician group of Wisconsin. 23119.

**Lyon**, Prof. D. G. (Harvard University, Cambridge, Massachusetts). Ten Assyrian and Babylonian seal-cylinders (lent for copying). 22352.

**McAllister**, W. (See under Pennsylvania Railroad Company.)

**McBrier**, T. M. (Murfreesborough, Arkansas). Specimen of peridotite from Pike County. 23116.

**McCandlish**, H. S. (U. S. Pension Office, Washington, District of Columbia). Specimen of *Ecphora quadricostata* Conrad from Bellfield near Yorktown, Virginia. 23053.

**McConnell**, Dr. J. C. (Army Medical Museum, Washington, District of Columbia). Pen and ink drawing of shell. 23324.

**McCoun**, Miss H. J. (Oyster Bay, Long Island). Jersey blue chicken and egg. 23104.

**McCoy**, John F. (Washington, District of Columbia). Three living American Chameleons (*Anolis principalis*) from New Orleans, Louisiana. 22987.

**McCullars**, D. C. (Motes, Alabama). Specimen of living Golden Eagle (*Aquila chrysaëtos*) 23082.

**McCully**, William W. (Athens, Alabama), (through Mr. J. W. Westfall). Specimen of flexible sandstone. 22775.

**McDaniel**, W. L. (Mineola, Texas). Five specimens of Helix (*Polygyra leporina* Gld.). 22867.

**McDonald**, Col. Marshall (U. S. Commissioner of Fisheries). Collection of books, consisting of Mahon's Permanent Works, Text and Plates, printed in Richmond, Virginia, by West and Johnston. Instructions for heavy artillery printed in Richmond, 1862; Light Infantry Tactics, New Orleans, 1861. Ordnance return of Colonel McDonald for the first quarter, 1803, and abstracts of issues of ordnance (at post of Vicksburg) for fourth quarter, 1862. 22181. (See under Fish Commission, United States.)

**MacFarlane**, R. (Cumberland House, Hudson's Bay Company). Marmot-skin blanket made by the Indians at Fort St. James, Stewart's Lake, New Caledonia district; pair of bears' feet moccasins; 6 mammal skins used for trimming: 3 young beavers and 3 white weasels, birds' skins, birds' eggs, nests, and 4 species of Coleoptera. 22503.

**McGee**, W. J. (See under Interior Department. U. S. Geological Survey.)

**McGillycuddy**, Dr. V. T. (Rapid City, South Dakota). Four living Buffaloes (*Bison americanus*) (deposit) 22431.

**McGregor**, Alexander (Georgetown, New Mexico). Specimens of descloizite, vanadanite, and descloizite pseudomorph from the "Commercial" mine (collected by Dr. W. F. Hillebrand, of the U. S. Geological Survey). 22535.

**McIlwraith**, T. (Hamilton, Ontario, Canada). Four specimens, representing 4 species of birds from British Columbia (exchange). 22210.

**McKee**, George W. (Major, U. S. Army, Allegheny Arsenal, Pittsburg, Pennsylvania). Specimen of living Chachalaca Pheasant from Mexico. 22587.

**McKnight**, Sarah. Living specimen of Screech Owl from Virginia. 22751.

**McLain**, Capt. George M. (Rockport, Massachusetts). Rigged model of the cutter-yacht *John Bull*. 22795.

**McLain**, Hon. T. J., jr. (Nassau, West Indies), (through Department of State). Four specimens of sisal. 23182.

**McLaughlin**, R. B. (Statesville, North Carolina). Eggs and nests of *Vireo solitarius albicola* (new to the collection). 22691.

McMasters, T. G. (Pittsburg, Pennsylvania), (through Mr. S. F. Peckham). Collection of specimens of crude petroleum. 22208.

McRae, Donald (Wilmington, North Carolina). Specimen of plant (name unknown), (sent to the United States Botanic Garden to complete its growth.) 22584.

Mabbett, Gideon (Rodney, Mississippi), (through Dr. A. K. Fisher, Department of Agriculture). Specimen of snake *Farancia abacura* (22314); nest, eggs, and parent bird of *Helmitherus vermivorus* (23304).

MacOwan, P. (See under Botanic Garden, Cape Town.)

Macdonough, James. (See under American Bank Note Company.)

Magee, Robert E. (Washington, District of Columbia). Specimen of Old-squaw (*Clangula hyemalis*) in flesh. 22574.

Mahone, Gen. William (Petersburgh, Virginia). Two living specimens of Gray Fox (*Urocyon virginianus*). 22204.

Maine State College (Orono, Maine), (through Prof. F. L. Harvey). Specimen of limonite from Katahdin Iron Works (exchange). 22472.

Manning, R. P. (Youngstown, Ohio). Five rude leaf-shaped implements, and seven fragments of flint implements, from Ohio, New York, Pennsylvania, and Illinois (exchange). 22324.

Marron, Thomas (United States National Museum). Autograph letter of Amos Kendall, dated October 26, 1838, while Postmaster-General during General Jackson's administration. 22825.

Marshall, George (U. S. National Museum). Three Passenger Pigeons (*Ectopistes migratorius*) in flesh (22461); specimens of birds' skins (22635); specimens of Purple Grackle (*Quiscalus quiscula*), Mallard duck (*Anas boschas*) in flesh (22922, 22983); specimen of Muskrat (*Fiber zibethicus*) Rat (*Mus decumanus*) with malformed incisors, in flesh (22996); specimen of Hooded Merganser (*Lophodytes cucullatus*) in flesh (23019).

Martin, John L. (Washington, District of Columbia). Specimen of Alligator (*Alligator mississippiensis*) from Florida. 22936.

Martin, R. H. (Washington, District of Columbia). Specimens of cocoons of the cecropia and promethea silk worms. 23231.

Mason & Hamlin (New York City). Model piano stringer, designed to exhibit two methods of adjusting or tuning wires, one a method patented by the donors July, 1883, the other an old method. 22435.

Mason, Prof. O. T. (U. S. National Museum). Specimens of ores, from the vicinity of Otis Creek, Upper Brazos River, Texas (22532); flint-lock musket, U. S., Springfield. (22890).

Mason, W. A., & Son (Cambridgeport, Massachusetts). Piece of plank from the wreck of the *Sparrowhawk*, and three plates of the same, together with a pamphlet giving an account of the wreck. 22781.

Mason, W. C. (Washington, District of Columbia). Three Chinese one-cash pieces. 22311.

Matthews, E. O. (St. Louis, Missouri). Alcoholic specimen of Rattlesnake (*Crotalus horridus*) from Indian Territory, and femora of an Indian from a mound in Madison County, Illinois. 22991.

Mayforth, Max (Washington, District of Columbia). Fifty-nine etchings, engravings, and lithographs. 22614.

Maynard, C. J. (Newtonville, Massachusetts). Four specimens of Cory's Booby (*Sula coryi*, Mayn) (purchase) (22251); species of Strophia, from the Antilles and Bahamas, types of the new species described by the donor (22530, 22744).

Maynard, G. C. (Washington, District of Columbia). Piece of the deep-sea portion of the first Atlantic telegraph cable. 23284.

Medina, José F. (See under Government of Nicaragua.)

Meeker, A. B. (District of Columbia). Specimens of hematite, chalcopyrite, and bornite from Virginia. 22948.

**Meeker**, S. F. (See under New Jersey Historical Society.)

**Meigs**, Gen. M. C. (U. S. Army) (Washington, District of Columbia). Whistle alleged to have been found in an Indian mound near Columbus, Georgia (22336); concretion composed mainly of limonite mixed with sand (22743).

**Mendenhall**, Dr. T. C. (See under Treasury Department, U. S. Coast and Geodetic Survey.)

**Menge**, J. F. (Myers, Florida). Eggs of *Speotyto cunicularia floridana* (purchase); nest of *Rostrhamus sociabilis*. 23300.

**Mercer**, R. W. (Cincinnati, Ohio). Specimens of stone implements from Lawrence County (exchange). 23055.

**Merriam**, Dr. C. Hart (Department of Agriculture). Twenty specimens of *Exogyra arietina* Roem. from the Cretaceous formation at Del Rio, Texas. 22931. (See under Department of Agriculture.)

**Merrill**, George P. (U. S. National Museum). Skin of Field-mouse (*Hesperomys leucopus*), and skin of Richardson's Ground Squirrel (*Spermophiluis richardsoni*) (22357); 4 species of fresh-water Gasteropods from Madison County, Montana (22400); miscellaneous collection of geological materials (purchase) (22696); 2 specimens of alligator-lizard, from the Yellowstone National Park (22895); series of rocks, showing inclosures of gneiss, limestone, etc., in eruptive granite from quarries at Sykesville, Maryland (23216). (Also under U. S. National Museum.)

**Merrill**, James C. (Assistant Surgeon, U. S. Army, Fort Reno, Indian Territory). Collection of birds' eggs, *Tympanuchus pallidicinctus*, *Spiza americana*, *Quiscalus quiscula æneus*, *Cardinalis cardinalis*, *Molothrus ater*, and *Vireo bellii;* collection of birds' skins, comprising *Tympanuchus pallidicinctus*, *Colinus virginianus texanus* and *Ammodramus savannarum passerinus*. 23290.

**Merrill**, L. B. (Paris, Maine). Specimens of minerals from Maine (exchange). 22926.

**Merrimon**, W. B. (See under R. A. Burch.)

**Merritt**, W. A. (Washington, District of Columbia). Specimen of Fish-crow (*Corvus ossifragus*) from the Eastern Branch of the Potomac River. 22766.

**Metz**, Dr. C. F. (See under Peabody Museum.)

**Michel**, E. (London, England), (through Mr. C. A. Baratonni). Photograph of Cugnot's steam road carriage, 1784, now in Conservatoire des Arts et Métiers, Paris. 22228.

**Miles**, H. W. (Washington, District of Columbia). Specimen of Bob-white (*Colinus virginianus*). 22799.

**Miller**, Mrs. N. V. D. (Washington, District of Columbia). Reprint of the wall-paper edition of the Vicksburg Daily Citizen, set up for print July 2, 1863, before the surrender to General Grant, and issued by his order July 4, 1863; reprint of the Ulster County Gazette, published at Kingston by Samuel Frear & Sons, Saturday, January 4, 1800. 22971.

**Millbr**, Prof. L. W. (See under Penn's Museum and School of Industrial Art.)

**Miller**, William (New York City). Ink ball and folder, used for taking hand-proofs of wood cuts. 22509.

**Milligan**, J. D. (Boston, Massachusetts). Two specimens of *Cypraea arabica* Linn. from the Samoan Islands. 22560.

**Mills**, Robert A. (Chuluota, Florida). Specimens of prehistoric pottery and human bones from shell mounds on St. John River, and a modern ax, plowed up on Indian Field Mound, on the Brevard County side of the river. 23196.

**Mills**, Theodore A. (Washington, District of Columbia). Commission of Clark Mills as first lieutenant of cavalry, militia of the District of Columbia, dated July 20, 1853, signed by Franklin Pierce, President of the United States, and Jefferson Davis, Secretary of War. 23331.

**Miner**, S. O. (Brattleboro, Vermont). Silver-spangled hen and eggs. 23274.

**Molan**, James (St. Augustine, Florida). Specimen of alligator. 22797.

**Molnar, Louis** (Molna Szecsöd, Epyházos Hollós, Hungary). Eighty-six specimens, representing 68 species of birds' skins; 6 mammal skins *Cricetus frumentorius, Myoxus glis, Spermophilus citellus, Sciurus vulgaris*, and *Ermacius europæus* (exchange). 22230.

**Monroe, J. A.** (Lumber Bridge, North Carolina). Specimen of Eureka game chicken. 23313.

**Monroe, J. P.** (Ringgold, Tennessee). Chain of copper or brass found in a mound in Montgomery County. 22679.

**Mooney, James** (Cherokee, North Carolina). Mortar and pestle; alcoholic specimens of reptiles, insects, and a large stump of a tree with bowlders embedded. 22419. (See under Bureau of Ethnology, U. S.)

**Moore, Baldwin** (District of Columbia). Specimen of opal and graphite, and apatite and menaccanite from Nelson County, Virginia. 23144.

**Moore, Harry** (Washington, District of Columbia). Two living specimens of Alligator (*Alligator mississippiensis*). 22617.

**Moorehead, W. K.** (U. S. National Museum). Two arrow-points from Licking County, Ohio (22689); stone implements from near Fort Ancient (22695); twenty rude flint implements, nine spear-heads and one hammer-stone from Greene County (23086).

**Morcom, G. F.** (Chicago, Illinois). (See under Shufeldt, Dr. R. W.)

**Morgan, Hon. T. J.** (Commissioner of Indian Affairs, Department of the Interior.) (See under Interior Department.) Wooden hoe from the Indians of Chippewa Reservation, Wisconsin. 23171.

**Morgan, H. de** (New York City). Collection of bones, from Armenian graves at or near Allah-Verdi, collected by the donor (22244); specimens of prehistoric antiquities, also collected from Armenia (22264).

**Morrison, Prof. James H.** (Lexington, Virginia). Specimens of shells comprising different species of *Helix hortensis L. and Helix memoralis* (22253, 22261); collection of Ordovician (Trenton) fossils, comprising *Strophodonta* sp. ? *Bellerophon bilobatus* Sowerby, *Raphistoma subtilistriata* Hall, *Murchisonia milleri* Hall (?), *Orthoceras junceum* Hall, *Orthoceras* sp. ?, and *Encrinurus* sp. ?, representing 6 genera and 7 species (22285); 32 specimens, representing 7 species and varieties of fresh-water mussels from North River (22448); samples of iron ore from Virginia and West Tennessee (22639); 14 specimens, representing 5 species, of fresh-water mussels (27814).

**Morrow, H. W.** (Wilmington, Delaware). Specimen of White-footed Field-mouse (*Herperomys leucopus*) in flesh. 22709.

**Morton, Dr. Henry**, (President Stevens Institute of Technology, Hoboken, New Jersey). Original dividing engine of J. Ramsden, and slide-rest with which the screws and gear-cutters were made. (23056). (See under Stevens Institute of Technology.)

**Mullin, John H.** (See under Fort Payne Coal and Iron Company.)

**Mumly & Thomas** (Baldwin, Long Island). Pair of imperial Pekin Ducks, duckling and egg. 28033.

**Museo Michoacano** (Morelia, Mexico), (through Dr. Nicolas Leon). Bark and fruit of *Cascara amarga*. 23008.

**Museum of Comparative Zoölogy** (Cambridge, Massachusetts). Alcoholic specimens of South American Siluroids (22526); 11 specimens, representing 2 species, of cray-fishes *Cambarus sloanii* Bundy from southern Indiana (22853).

**Museum of Natural History** (Genoa, Italy), (through Marquis Giacoma Doria, director). Skin and skull of *Lophiomys inhausii*, 100 bats in alcohol, 2 shrews, and 1 Meadow-mouse (exchange). 23079.

**Museum of Natural History** (Paris, France). Samples of hair representing various races, as follows: Fuegians, South America; Grand Canary; Somalis; Borneo; Sumatra; Galla and Soketo negro; Tonga tabu; Easter Island; New Zealand; Caroline Islands; New Hebrides, and New Caledonia (exchange),

**Museum of Natural History** (Paris, France)—
(22283); 2 meteorites from different localities (exchange), (22413); meteoric stone from Aumale, Algeria (exchange), (22943).

**Museum, the Demerara** (British Guiana), (through Mr. J. J. Quelch). Four skins of adult Hoatzins (*Opisthocomus cristatus*), and 7 alcoholic specimens of chickens and skeletons of the same species (exchange). 22356.

**Myer, W. E.** (Carthage, Tennessee). Two hundred and seven specimens of human and animal bones, flint chips, shell beads, and fragments of cave earth. 22771.

**Natural History Museum** (Oxford, England), (through Mr. Henry Balfour). Model of a Hindoo fire-drill, used to make sacred fire in temples (exchange). 23212.

**National Museum, U. S.**

Collected by Mr. George P. Merrill, of the National Museum, and Dr. A. C. Peale, of the U. S. Geological Survey. A miscellaneous collection of geological materials from Madison County, Montana. 22868.

Model of an ancient fire-engine, made from a drawing taken from a book on "Surveying," by Cyprian Lusar. This model was made by Mr. C. R. Lacombe, preparator. 23005.

Specimens of zircon, sphene, xanthitan, pseudomorph after sphene, epidote, allanite, and vermiculite from the Jones Zircon Mine, Green River, Henderson County, North Carolina (collected by William S. Yeates). 22347.

**Navy Department, U. S.** (through Commodore J. G. Walker, Chief of the Bureau of Navigation). Specimens of ocean-bottom, taken in the North Atlantic Ocean during the passage of the United States steamer *Dolphin*, under the command of Commander George F. F. Wilde, from the Straits of Gibraltar to New York (22469); ethnological objects from Samoa, presented by Malietoa Mataafa and other chiefs of high rank, to the United States Government, through Rear-Admiral Kimberly, in token of their appreciation of the interest shown by the Government during their troubles; some of the mats presented are of great value as heirlooms (23197).

**Negus, Miss B. R.** (Los Angeles, California). Two reed-canes with thongs, from the roof of the Mission Church at San Fernando. 22979.

**Nehrkorn, A.** (Riddagshausen, Braunschweig, Germany). Five bird-skins, representing 5 species, from Palawan (exchange). 22863.

**Nelson, J. P. G.** (Alexandria, Virginia). Living specimen of Red-tailed Hawk. 22644.

**New Jersey Historical Society** (Newark, New Jersey), (through Mr. S. F. Meeker). Portion of the cylinder of the Hornblower engine, imported from England in 1753, the first steam engine erected in the Western Continent. 23163.

**Newlon, Dr. W. S.** (Oswego, Kansas). Flint implements from Edgar County, Illinois; a notched ax, large flint knife, and specimen of Green snake. (22[illegible], 22836.)

**New York, University of the State of** (Albany, New York), (through Mr. J. S. Smock). Section of Potsdam sandstone *Climatichnites wilsoni* Logan (?), quarried at Port Henry, a fine illustration of tracks and ripple marks. 23156.

**Nicaragua, Government of** (through Mr. John Crawford, Mr. José Medina, Mr. J. Durand, and the Department of State). Collection of engraved cocoa and chocolate cups, specimens of birds, reptiles, lava figures, specimens of scorpions, spider, caterpillar, myriapod, and a hammock. 23200.

**Nicholson, J. B.** (Brightwood, District of Columbia). Specimens of *Didelphys virginiana*. 22877.

**Niehaus, Franz** (Washington, District of Columbia). Specimen of American Crossbill (*Loxia curvirostra minor*) in the flesh. 22731.

**Niven, William** (New York City). Specimens of quartz crystals, cut jasper, agate, native copper, native silver, and a dish made of agatized wood. 22377.

**Noah, John M.** (U. S. National Museum). Badge of Maysville Commandery of Knights Templar (22454); original copy of the Carriers' Address to the Patrons of "The National Advocate," New York City, January 1, 1817, (22559); admission cards (press and citizen) to ceremonies in commemoration of the inauguration of the first President of the United States, held December 11, 1889, in the House of Representatives (22831); special tickets and menu cards of the editorial excursion, via Pennsylvania Railroad, Cumberland Valley Railroad, and Shenandoah Valley Railroad, to Luray Cave, May, 1888 (23096).

**Noble, Hon. John W.** (Secretary of the Department of the Interior). (See under Interior Department.)

**Norman, Rev. A. M.** (Durham, England). Alcoholic specimens of crustacea and echinodermata, chiefly Mediterranean (exchange). 22219.

**Norris, H. D. B.** (Marshall, Virginia). Living specimen of hawk. 22477.

**Nuttall, Mrs. Zelia** (Dresden, Saxony). Ancient carved Norwegian cart-harness. 22568.

**Nutter, Frank H.** (Minneapolis, Minnesota). Nine specimens of batrachians; larva of Tiger Salamander (*Amblystoma tigrinum*). 23032.

**Nye, Willard, Jr.** (New Bedford, Massachusetts). Specimen of Winter Wren (*Troglodytes hiemalis*). 23018.

**Oberlin College** (Oberlin, Ohio). Collection of occipital plates and other portions of *Dinichthys Terrelli*, Cleveland shale of Lorain County (22198); (through Mr. Albert A. Wright) collection of ethnological specimens from Africa (exchange), (22262).

**O'Neil & Hillis** (Mullan, Idaho). Five specimens of pyromorphite on limonite, and one specimen of cerussite in quartz from the "Little Giant" mine, Hunter mining district, Shoshone County. 22391.

**Orcutt, C. R.** (San Diego, California). Alcoholic specimens of Anchovy (*Stelephorus delicatissimus*); alcoholic specimens of *Bruchus obselotus* Say, *Dacre californica* Sloan, *Thinopinus pictus* Lec, and *Hygrothechus remgis* Say; collection of starfishes, corals, sponges, Brachyurans, Anomurans, Amphipods, Isopods, Entomostracans, Annelids, Planarians, Holothurians from Todos, Santos Bay, Lower California. 22456.

**Osborne, J. W.** (Washington, District of Columbia). Fourteen mounted photographs used to illustrate a paper read before the Washington Philosophical Society, October 13, 1888 (22290); 139 specimens of photo-mechanical process work, engravings, etc. (23155); "Paris-Noel" 1888–1889, text with process illustrations and two extra plates (23217); pamphlet entitled "Photography in Printing Ink, Pouney's Patent Process, by Thomas Sutton, B. A., London, 1863 (23275).

**Osgood, Prof. Howard** (Rochester, New York). Cast of a stone containing a Greek inscription, from the Temple at Jerusalem (exchange). 22692.

**Overton, Dr. William S.** (Stony Creek, Virginia). Soldier's pardon for taking part in the late rebellion, dated July 5, 1866, signed by William H. Seward, Secretary of State. 23067.

**Oxford University Museum.** (See under Mr. Henry Balfour.)

**Palestine Exploration Fund** (London, England). Thirty-one photographs. 22944.

**Palmer, Joseph** (U. S. National Museum). Specimen of Shrew (*Blarina* sp.) in flesh. 22995.

**Palmer, William** (U. S. National Museum). Specimen of mink *Putorius vison* (22235); specimen of Wood Hare (*Lepus sylvaticus*) in flesh, and skull of Opossum *Didelphys virginiana* (22923); 3 Gray Squirrels (*Sciurus carolinensis*), and White-footed Mouse (*Herperomys leucopus*) (22994); skull and partial skeleton of Kinkajou (*Ceroleptes caudivolvulus*) (22999); 2 living specimens of Canada Goose (*Branta canadensis*) from Baltimore, Maryland (23058); specimen of lizard from San Francisco (23184).

**Payne, Gen. Walter S.** (Fostoria, Ohio). Badge and officers' ribbons of the Sons of Veterans, U. S. Army. 23004.

Peabody Museum (Cambridge, Massachusetts), (through Prof. F. W. Putnam). Collection of archæological objects from graves near Madisonville, Ohio; basket from Chile; torches from Mammoth Cave, Kentucky (collected by Prof. F. W. Putnam and Dr. C. F. Metz). 2311.

Peale, Dr. A. C. (U. S. Geological Survey). (See under National Museum, United States.)

Peckham, T. G. (See under T. G. McMasters.)

Penick, R. A. (South Boston, Virginia). Stone implements and stone pipe from Halifax County. 22670.

Penn's Museum and School of Industrial Art (Philadelphia, Pennsylvania), (through Prof. L. W. Miller, principal). Pen and ink drawing; water-color study; designs in body colors executed by different students. 22421.

Pennsylvania Railroad Company (Camden, New Jersey), (through Mr. W. McAllister). Slot-stem and ring-joint fixture. 23318.

Pennsylvania Salt Manufacturing Company. (Philadelphia, Pennsylvania), (through Mr. Thomas Armstrong, president). Specimens of cryolite from Evigtok, Arksut-fiord, Greenland. 22541.

Peregrino, F. Z. S. (Pittsburg, Pennsylvania). Photograph of donor, and a hand basket, from Africa. 23072.

Pereira, Lyndwode. (See under Interior, Department of, Ottawa, Canada.)

Perry, Miss Edith (U. S. National Museum): Specimen of *Polyphemus*. 23248.

Perry, E. W. (Truxville, Honduras), (through Mr. H. W. Perry). Two photographs, representing three views of a stone image, found in Honduras (22354); image made of soapstone found in a subterranean chamber at Copan, Honduras (22859).

Perry, N. H. (South Paris, Maine). Specimens of cancrinite in elæolite-syenite, lepidomelane, lepidolite, spodumene, rose quartz, massive topaz, vesuvianite, elæolite in elæolite-syenite, pink tourmaline in lepidolite, triphyllite, and triplite. 22548.

Perry, W. H. (See under E. W. Perry.)

Peter Redpath Museum (McGill College, Montreal, Canada), (through Sir J. William Dawson). Five specimens, representing 2 genera and 2 species of Lower Cambrian *Ptychoparia metisensis* sp., Walcott, and 3 specimens (2 casts) of *Agraulos redpathi* n. sp., Walcott. 23137.

Peters, Dr. John P. (Constantinople, Turkey). Shepherd's pipe, a specimen of those used among the Arabs of Irak, Mesopotamia, south of Bagdad, bought from an El Budier Arab (a small independent tribe) 30 miles east of Dirvaniyh. 2232.

Pettit & Dripps (Washington, District of Columbia). Two living specimens of Gray Rabbit (*Lepus sylvaticus*). 22207.

Phillips, Barnet (Brooklyn, New York). Pair of Afghan sandals. 22384.

Phillips, Hallett W. (Washington, District of Columbia.) Paper by George Catlin on a "steam raft," Manchester, 1860. 22940.

Phillips, N. Taylor (New York City). Silk taleth, a garment worn by men in the Jewish Synagogue. 22698.

Phillips, Oscar (Washington, District of Columbia). Specimen of Woodcock (*Philohela minor*) (22946); specimen of Screech Owl (22693).

Phinney, E. (Cooperstown, New York). Specimen of *Coregonus labradoricus* from Musquaw River. 23169.

Pike Manufacturing Company, the (Pike Station, New Hampshire). Specimens of fossil whetstones and sandstone from Orange County, Indiana. 22812.

Pike, Nicholas (Brooklyn, New York). Two musical instruments. 22690.

Pilsbry, H. A. (Academy of Natural Sciences, Philadelphia, Pennsylvania). Two specimens of *Helix hippocrepis* Pfr, and 2 specimens of *Conotrochus singaporensis* Pilsbry from Singapore. 22254.

Pittsburgh Reduction Company (Pittsburgh, Pennsylvania). (through Mr. A. E. Hunt, President). Eexhibit of articles manufactured from aluminium. 2296.

Pleas, C. E. (Clinton, Arkansas). Specimens of land and fresh-water shells from Little Red River and the neighboring mountains (exchange). 22818.

Poesche, Herman (Washington, District of Columbia). Specimen of Trumpeter pigeon (22389); specimen of black-breasted red game Bantam hen (22715).

Poesche, Victor (Washington, District of Columbia). Two pairs of Archangel pigeons. (22388, 22874); specimen of Archangel Pigeon for skeleton (22663); black-breasted game Bantam cock (22803).

Poesche, V. L. (Washington, District of Columbia). Specimen of Archangel Pigeon, in flesh. 22508.

Pohlman, Dr. Julius (Buffalo, New York). Forty-five specimens of fossils, from Water-line Group, Buffalo, New York. 23251.

Pond, Lieut. Charles F. (U. S. Navy), (Navy Yard, Mare Island, California). Specimens of rocks; Port Jackson Shark (*Heterodontus francisci*) from Lower California; shells, *Helix* sp. from Cerros Island; sponges, photograph of *Elephant Tree*, egg of hawk from Cerros Island, Nullipore coral from San Benito Islands, and lower jaw of porpoise *Tursiops gillii* from Fort San Bartolme. 22807.

Powell, Maj. J. W. (Director of the U. S. Geological Survey). Thirty-eight objects, offerings from shrines, from New Mexico. 23046. (See under Interior Department, U. S. Geological Survey.) (See under Bureau of Ethnology U. S.)

Power, J. B. (Kingsville, Ohio). Specimen of Black Chipmunk *Tamias striatus*. 23327.

Prang, L. & Co., (Boston, Massachusetts). Four small lithographs of yachts and sloops. 22773.

Price, Charles P. (Washington, District of Columbia). Two living opossums, *Didelphys virginiana*. 22618.

Pringle, C. G. (Charlotte, Vermont). Three hundred and sixty-five specimens of dried Mexican plants. (23094, 23305.)

Proudfit, S. V. (Falls Church, Virginia). Two thousand three hundred and forty-five specimens of stone implements from the District of Columbia. 22641.*

Pursey, G. G. (Toronto, Canada). Fossil wood cut from log under a drift mound in blue clay, 60 feet below the surface, during the work of straightening the river Don at Toronto. 22332.

Pusey & Jones (Wilmington, Delaware). Rigged model of metal steamship in glass case. 22811.

Putnam, Prof. F. W. (See under Peabody Museum).

Quelch, J. J. (See under Museum, The Demerara, British Guiana.)

Ragsdale, G. H. (Gainesville, Texas). Alcoholic specimen of *Stenostoma* (purchase); alcoholic specimens of reptiles, and batrachians collected in Cook, San Jacinto, and Polk Counties, Texas, comprising *Opheosaurus ventralis*, *Phrynosoma cornutum*, *Anolis principalis*, *Oligosoma laterale*, *Eumeces tetragrammus*, *Cnemidophorus sexlineatus*, and *Sceloporus consobrinus;* alcoholic specimen of a Chickadee from East Texas. 22414.

Randall, William H. (Mystic Bridge, Connecticut). Piece of "reefing-point," with two knots in it, and fragments of the sail thrashed and twisted into the knots, done by the action of the wind *alone*, during a cyclone in the Pacific Ocean. 23143.

Randolph, Miss Cornelia (Washington, District of Columbia). Figurines of Sèvres Porcelain, from the collection of Marie Antoinette, brought from France by the Hon. Gouverneur Morris, United States minister, 1885 (deposit). 22907.

Ransom, C. L. (Norwich, Connecticut). Eggs of *Buteo lineatus*, and *Syrnium nebulosum*. 23134.

Ray, Capt. P. H. (U. S. Army), (Omaha, Nebraska). Three paleolithic implements from the Bridger basin on the north slope of the Uintah Mountains, Utah. 23282.

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* See Proceedings of the U. S. National Museum, vol. XIII, 1890, pp. 187–194.

**Raymond**, Dr. R. W. (New York). Hammer, partially altered to limonite, found in a mine in Honduras, which had not been worked for 200 years. 23041.

**Raymond**, W. J. (Oakland, California). Ten species of land and fresh-water shells (22745); 8 specimens, representing 2 species of marine shells from San Francisco Bay. 23252.

**Reames**, T. G. (Jacksonville, Oregon). Twenty-dollar gold piece of the United States, dated 1858, or 1866, and a Knights Templar badge. 22457.

**Redwood**, F. F. (Baltimore, Maryland). Specimen of Dyak Sumpitan or blow-gun, from North Borneo (exchange). 22973.

**Rei, Hiramatz** (Tokio, Japan), (through Hon. John F. Swift, United States minister). Section of rope made of human hair, used as an ordinary cable in lifting building-material in the construction of a Buddhist temple at Kyoto; photograph of the entire rolls of cables still remaining at the new Buddhist temple at Kyoto; table of the names of the provinces of the donors, showing the size and length of each of the ropes used in the construction of the Eastern Hongwan-ji Temple at Kyoto, and a lithograph of the famous Buddhist edifice. 23113

**Reid**, H. (Hoadley, Virginia). Five living specimens of *Lepus sylvaticus*, for a group (purchase). 22233.

**Rey**, Dr. E. (Leipzig, Germany). Collection of birds' skins from Asia and Siberia, all but two new to the collection (22380); collection of birds' skins from Syr-Darya and Canary Islands (purchase). 22397.

**Reynolds**, Dr. F. S. (Juneau, Alaska), (through Mr. I. C. Russell, of the U. S. Geological Survey). Specimen of silver ore from the "Silver Queen" mine. 22590.

**Rhees, William** J. (Smithsonian Institution). Specimens of *Equus caballus* and *Bos taurus* in the flesh from the District of Columbia. 22249.

**Rice, Willard** (Cienega, Arizona). Two specimens of minerals from near Salt Mountain, Verde Valley. 22735.

**Richards**, J. T. (Philadelphia, Pennsylvania). Brick from the foundation of old Fort Du Quesne, Pittsburg, built prior to the Revolutionary War. 23054.

**Richmond**, C. W. (U. S. Geological Survey). Eggs of Mocking-bird (*Mimus polyglottos*). 22256.

**Riddell, John** (Bay Center, Washington). Internal cast in lime of a small nautilus *Aturia Ziczac* Sowerby, a tertiary fossil common to Europe and America, found near Bay Center. 22927.

**Ridgway**, A. W. (Laurel, Maryland). Specimen of Snowbird (*Junco hyemalis*) killed by telegraph wires. 22671.

**Rigdway, Robert** (U. S. National Museum). Seventy-one specimens, representing 56 species of birds' skins, from Laurel, Maryland (22241, 22736); specimens of Greater Snow Goose (*Chen hyperborea nivalis*), and a Wild Turkey, both in flesh, from the Washington market (purchase), (22737, 22746); Wild Turkey (*Meleagris gallopavo*) from the Washington market (purchase) (22846); 2 photographs of objects in the national museum of Costa Rica (deposit) (22303).

**Riley**, Prof. C. V. (Entomologist, Department of Agriculture). Collection of 4,684 mounted insects, American and Australian, representing about 830 species of all orders, from Mr. A. Koebele, Los Angeles, California. 23340. (See under Department of Agriculture.)

**Rivers**, J. J. (Berkeley, California). Two specimens of *Succinea chrysis* West from Sitka, Alaska. 23191.

**Rives**, Dr. **William** C. (Newport, Rhode Island). Two specimens of the Mountain Vireo (*Vireo solitarius*), from White Top Mt., Virginia, new to the collection. 23103.

**Robinette, Frank** (District of Columbia). Living specimen of American Osprey (*Pandion haliaëtus carolinensis*) from Milford, Delaware. 23107.

**Robinson**, N. T. N. (See under Col. G. E. Dennis.)

**Robinson, Brothers** (Shawneetown, Illinois). Two flint scrapers and three points. 23016.

**Rockhill, W. W.** (Washington, District of Columbia). Collection of ethnological objects from Thibet (22455); sample of seeds of Yachou tea from Sechuen, Western China, from which all the Thibetan brick-tea is made (22459); sample of wool from Kokonor, Thibet (22696); ethnographical collection from eastern Thibet, western Mongolia, and China (22699); pair of silver earrings, finger ring, shirt buckle worn by women, and shirt-button from Eastern Thibet (deposit) (22700); specimens of Chinese money, including a national bank note, the only issue of the present dynasty, and a 100 cash note of the city of Pekin (22778); chased iron seal, scroll picture of the Lama Convent of Trashilhunpo, in Thibet, Chinese pipe and tobacco pouch; strike a-light, set with jewels with jade toggle; brass teapot; sword; knife and chopstick in case; bow, arrows and quiver, and bow case (deposit) (22821); corean paintings (costumes); joss sticks (incense), used in Thibet (two kinds) (22822); gold shirt buckle from Thibet, and an ivory crucifix, from near Genoa, Italy (22976).

**Rockwell, C. H.** (Commander U. S. Navy). Specimen of *Ostracion quadricorne*. 22959.

**Rockwood Pottery Company** (Cincinnati, Ohio). Three specimens to illustrate the manufacture of an inkstand from clay. 22190.

**Roessler, A. R.** (Austin, Texas). Specimen of gadolinite from Llano County; 24 specimens of dolomite, calcite, and hematite from Burnet County, and a specimen of chalcocite, from Archer County (22367); 3 specimens representing two genera and two species of *Productus* sp. ? and *Spirifera* sp. ? from Burnet County (22407).

**Rogan, J. W.** (Rogersville, Tennessee). Specimen of *Piloceras* sp. undet. from the Calcareous formation of Ordovician from Hawkins County. 22579.

**Rogers, William** (Bath, Maine). Builder's model of the ship *Mayflower*. 22784.

**Romkyn, Capt. Henry** (U. S. Army), (Fort Ringgold, Texas). Clay tunnels constructed by ants (purchase) (22351); 13 living specimens of White-winged Doves (*Melopelia leucoptera*) (22369); 2 living Peccaries (*Dicotyles tajaçu*) from southern Texas (22787).

**Royal Museum** (Stockholm, Sweden). Specimens of minerals from Sweden, Norway, Finland, and Greenland (exchange). 23172.

**Russell, I. C.** (U. S. Geological Survey). Specimen of roofing-slate, from Rockmart, Georgia (23001); 22 photographs of scenery of the Great Dismal Swamp (23209). (See under Dr. F. S. Reynolds.)

**Safford, W. E.** (ensign U. S. Navy), (Chillicothe, Ohio). Thirty-three ethnological objects, collected by the donor in Samoa. 22259.

**Sanborn, W. D.** (Winchester, Massachusetts). Seven daguerreotypes of Sioux Indians, taken from life, 40 years ago. 23025.

**Sandy Point Ducking Club** (Middle River, Maryland), (through Mr. G. A. Gambrill). Mounted specimen of Albino Red-head Duck. 22713.

**Sanford, Capt. E. H.** (Baltimore, Maryland). Peak-crested, white-winged Turbit Pigeon, in flesh. 22436.

**Sapporo Agricultural College** (Sapporo, Japan), (through Shosuke Sato, acting director). Collection of Aino articles (exchange). 22633.

**Sato Shosuke.** (See under Sapporo Agricultural College.)

**Sayles, Ira** (U. S. National Museum). Upper molar of *Elephas americanus* from Tioga County (22284); 4 pitted stones (22323); 311 shells from ancient Küchen Midden's, near Strawberry Plains, Tennessee (22819).

**Savage, M. F.** (New York City). Pottery lamps from Tyre and Alexandria. 22428.

**Scarff, Arthur E.** (Kalamazoo, Michigan). Pack of Spanish Monté cards (23091); Siamese copper coin, and copper coin (dos centavos) of the Argentine Republic (23148).

Schieffelin, W. H., & Co. (New York City). Ninety specimens of materia medica. 22972.

Schmid, Edward S. (Washington, District of Columbia). Pair of dove house pigeons in flesh, for mounting (22456); 3 common pigeons and 3 homing pigeons (22577, 22802); Silver-bill Finch-Warbler, living domestic fowl and white leghorn cock (22611); White Leghorn fowl (22624); Blue-rock pigeon (22716); two specimens (male and female) of Strawberry Finch, in flesh (22779); specimen of *Putorius fœtidus* in flesh (22882); European quail (22966); specimen of *Lepus corniculus* (22993); Muskrat (*Fiber zibethicus*) for skeleton (23077); Least Bittern (*Ardetta exilis*) (23222).

Schmidt, Dr. F. (St. Petersburg, Russia). Specimen of *Obolus apollinis* Eichwald from the Upper Cambrian of Esthnonia, Russia. 22712.

Schmidtt, Nicholas (Soldiers' Home, Washington, District of Columbia). Cocoon of Fork-tail Moth (*Cerura cinera*). 23270.

Schoenhof, Carl (Boston, Massachusettts). Manual of Electro-metallurgy (Shaw) London, 1884, with two illustrations of Palmer's Glyphography and description of the process (purchase). 22723.

Schonborn, Henry F., jr. (Washington, District of Columbia). Black-throated Blue Warbler (*Dendroica cærulescens*) in flesh. 22399.

Schuermann, C. W. (Smithsonian Institution). Specimen of spider *Argiope riparia*. 22294.

Schuttler & Hotz (Chicago, Illinois). Mexican cart. 22668.

Scientific Publishing Company (New York City). Two sets of plates of Mr. George F. Kunz's work on gems. 23309.

Scollick, J. W. (U. S. National Museum). Plymouth Rock and light Brahma fowls. 23179.

Scott, C. T. (Upperville, Virginia). Arrow-head found on Goose Creek. 23261.

Scott, F. H. (Westfield, Massachusetts). Two mounted Red Squirrels (*Sciurus hudsonius*). 23167.

Scott, Samuel (Rapid City, South Dakota). Two specimens of liebenerite. 23243.

Seal, William P. (See under Fish Commission, U. S.)

Sellner, John J. (Camp Spring, Maryland). Four specimens of *Lepus sylvaticus* with nest (purchase). 22234.

Selwyn, Dr. A. R. C. (Director of the Geological Survey of Canada, Ottawa, Canada). Eleven specimens representing 4 genera and 4 species of fossils from the calciferous formation of the Lower Silurian at Cape Rozier, consisting of *Dichograptus* sp., *Clonograptus flexilis*, Hall, *Callograptus salteri*, Hall, and Brachiopoda, sp. undet. 22444.

Semmes, John H. (Washington, District of Columbia). Specimen of Crab, *Gecarcinus ruricola* Latr., brought from the tropics in a box of bananas. 23181.

Sennett, George B. (American Museum of Natural History, New York). Specimen of Lomite Wren (*Thryothorus ludovicianus lomitensis* Senn.), new subspecies, from Texas. 22816.

Sewall, Harold M. (Bath, Maine). Samoan fire-stick. 22187.

Shanks, P. M. & Co. (London, W. C., England). Samples of work done on Shanks's Engraving Machine, with a description of the machine. 22522.

Sharp, C. A. & Co. (Lockport, New York). Indian-game hens and chickens (22958, 23235, 23245), white Wyandotte fowl (23210).

Sheldon, Henry L. (Middleburgh, Vermont). Ten sets of Vermont Glass Factory Bills, 1814 (22664); paper money issued by the Vermont Glass Company, Salisbury, 1814, and fractional currency issued by H. A. Sheldon, 1862 (22578).

Shick, Charles S. (Sea Isle City, New Jersey). Eggs of *Pandion haliaëtus carolinensis*. (23208, 23253.)

Shindler, A. Zeno (U. S. National Museum). Specimen of Axolotl (*Sirenidon mexicanum*). 22250.

Shriver, Howard (Wytheville, Virginia). Seven arrow-points (22471); specimen of lichen and fern from Will's Mountain, Cumberland, Maryland (23298).

Shufeldt, Percy W. (Takoma, District of Columbia). Specimen of *Junco hyemalis shufeldti* from Fort Wingate, New Mexico (exchange). 22201.

Shufeldt, Dr. R. W. (U. S. Army), (Takoma, District of Columbia) (and G Prean Marcom). Skeleton of Trumpeter Swan (*Olor buccinator*) (22182); 8 specimens, representing 3 species of Juncos, from Fort Wingate, New Mexico (22202); 150 alcoholic specimens of birds, and 5 alcoholic specimens of mammals (22974); specimens of *Merganser americanus*, *Lophodytes cuicullatus*, *Anas boschas*, *Anas americana*, *Anas carolinensis*, *Spatula clypeata*, *Dafila acuta*, *Aythya americana*, *Aythya vallisneria*, *Aythya affinis*, *Aythya collaris*, *Glaucionetta clangula americana*, *Charitonetta albeola*, *Branta canadensis*, *Anser albifrons gambeli*, *Chen hyperborea nivalis*, *Aix sponsa*, and *Chen cærulescens* in flesh (23037); 3 alcoholic specimens of reptiles, from the same locality (23242).

Shutt, George W. (Hillsborough, Virginia). Living specimen of Red Fox (*Vulpes fulvus fulvus*). 22272. (See under Interior Department. U. S, Geological Survey.)

Sidey, J. F. (Buffalo Gap, South Dakota). Specimens of lime crystals. 23045.

Silva, Carlos Martinez (United States of Colombia, South America). Collection of butterflies, from the famous emerald mines of Muzo, Boyacá, the only locality where these species are found, namely, *Pavonia telamonias* Felder, *Morpho* sp., and *Morpho Cypris* Boisd. 23105.

Simpson, D. A. (Sullivan, Maine). Builder's model of two-masted hermaphrodite brig. 22653. (See under W. H. Abbott.)

Simpson, Marshall (Washington, District of Columbia). Specimen of Flying Squirrel (*Sciuropterus volucella volucella*). 22355.

Sinckll, Charles W. (Washington, District of Columbia). White and gray rat. 23223.

Singer, Lieut. Frederic (U. S. Navy). Specimen of Termite queen from Sinou County, Liberia. 22742.

Singley, J. A. (Giddings, Texas). Fifteen species of land and fresh-water shells, from Texas (22287, 23020); eggs of *Buteo lineatus alleni* (purchase) (22941); skin of White-breasted Nuthatch (*Sitta carolinensis*) (23124).

Slocum, Capt. Joshua (Boston, Massachusetts). Specimen of *Spondylus* from St. Lucia, West Indies (22785); photograph of the boat *Liberdade* (22783).

Smillie, James D. (New York City). Dry-point plate, with three proofs, and tools used in dry-pointing (purchase) (22557); 4 working proofs, and one signed remarque proof "The Goldsmith's Daughter," and etching by the donor, from a painting by D. Huntington (22558); 4 prints, from a mezzotinted plate, by the donor, to show the several stages of the work (22748); 5 proofs from bank-note dies, and proof from a medal-ruled plate (23276).

Smith, Hon. Edmund W. P. (Washington, District of Columbia). Two living South American Guans, from Carthagena, United States of Colombia, collected by Mr. Smith, while United States Consul. 22315.

Smith, Edward C. (Newport, Rhode Island). Blue Lobster, caught by the donor. 22252.

Smith, H. G., jr. (Denver, Colorado). Collection of reptiles and batrachians (exchange). 22980.

Smith, Dr. Hugh M. (U. S. Fish Commission). Skin of Scarlet Tanager (*Piranga erythromelas*), in transition plumage, from Thoroughfare, Virginia (22838); 8 specimens of shells, from Cape May, New Jersey (22918); 2 specimens of *Lepus cuniculus* (22992); 2 parasites, taken from a harbor seal (23042); 5 specimens of mammal skins from the District of Columbia and vicinity (23219); photographs

Smith, Dr. Hugh M.—Continued.
of the steamer *Penobscot*, U. S. Revenue Marine Cutter *Levi Woodbury*, and the wharf at Castine, Maine (22726).

Smith, Prof. John B. (New Brunswick, New Jersey). Types of 16 species of *Agrotis* (22780); 15 species of various insects (exchange) (23307).

Smith, Dr. M. C. (Lynn, Massachusetts). Specimen of selenite crystals, massive selenite, and howlite, from Windsor, Nova Scotia. 22843.

Smith, W. B. (U. S. Geological Survey). Eighty-eight specimens of phenakite, garnet, topaz, amazonstone, samarskite, gadolinite, azurite, malachite, wulfenite and pyrite, alabandite from Colorado and Arizona (purchase). 22368.

Smith, Willard P. (Passaic, New Jersey). Pair of living Langshan chickens. 23330.

Smith, W. R. (Superintendent of the U. S. Botanic Garden, Washington, District of Columbia). Three living domestic Albinos. 22440.

Smock, J. C. (See under University of the State of New York.)

Southwick, J. M. (Providence, Rhode Island). Nest and eggs of *Piranga hepatica* (purchase). 22905.

Spainhour, Dr. J. M. (Lenoir, North Carolina). Leaf-shaped implement. 23309.

Spencer, V. O. (Lake Worth, Florida). Specimen of Bat-fish (*Malthe cubifrons*). 22242.

Speyer, Felix (Franklin, Pennsylvania). Copper coin of Portugal (twenty reis), 1866. 22608.

Spillman, W. J. (Vincennes, Indiana). Specimens of mollusks, shells, and fossils from Saugeen River, Ontario, and Wabash River, Ohio. 23076.

Spofford, Master Robert W. (Washington, District of Columbia). Collection of shells from the West Indies. 22402.

Springer, James E. (Green Garden, Pennsylvania). Specimen of *Sceloporous undulatus*. 22277.

Stabler, Harold B. (Sandy Spring, Maryland). Specimen of *Buteo borealis*. 22623.

Stanley, G. W. (Washington, District of Columbia). Red-breasted Merganser (*Merganser serrator*). 23177.

Stanton, T. W. (Washington, District of Columbia). Twenty-five specimens, representing 3 species of land-shells from Chihuahua, Mexico. 22453.

Stanton, W. M. (New York City). White-crested black Polish hen. 22933.

State Department, U. S. (See under Government of Switzerland. Thomas J. Mc-Lain, jr. Government of Nicaragua.)

Stearns, Frederick & Co. (Detroit, Michigan). Sample of bark, said to be the true *Cascara amarga*. 23097.

Stearns, Dr. R. E. C. (U. S. National Museum). Specimen of limestone from near Selkirk, line of the Canadian Pacific railroad. 23199.

Stebbins, N. L. (Boston, Massachusetts). Photographs of yacht building, yachts, merchant steamers, pilot boats, fishing schooners, etc. 22930.

Steinert, M. (New Haven, Connecticut). Concert grand piano of the Mozart period, made by Madame Nanetta Streicher, Germany, 1790. Concert grand piano of the Beethoven period, made by Joseph Hisky, Vienna, 1816 (23317); two square pianos from London, England, and an upright piano from Germany (23324); square piano, 1820, made in Philadelphia, Pennsylvania, and one, made by Hisky, of Baltimore (23351); harpsichord (1776) from London; clavichord of the sixteenth century, from Germany; violin (1634) from Germany; violin (1740) from Venice; viola (1721) from Germany; viola (1738) from Germany; violincello (1862) from Germany, and zither (23353).

Stejneger, Dr. Leonhard. (U. S. National Museum). Ten specimens, representing 8 species of birds' skins, from Arizona, and 2 skins of *Tamias asiaticus dorsalus* and *Tamias leucurus* (22466); collection of mammal skulls, reptiles,

**Stejneger, Dr. Leonhard**—Continued.
birds' skins, roosting nest of *Auriparus flaviceps*, 8 specimens of *Heterandria occidentalis*, from Arizona (22524); 11 specimens, representing 11 species of birds' skins, from Silver City, New Mexico; 6 specimens, representing 6 species, from Fort Huachuca, Arizona, and a skull of mammal (22573); 7 specimens, representing 6 species of birds' skins, from New Mexico and Arizona (22606); collection of mammal skins and skulls and reptiles from Arizona, New Mexico, and Texas. (22809, 22896).

**Sterki, Dr. V.** (New Philadelphia, Ohio). Twenty-eight species of small land-shells from various localities in the United States, illustrating papers by the donor. 23127.

**Sterling, Dr. E.** (Cleveland, Ohio). Mounted skeleton of a male Long-tailed Duck. 23271.

**Stevenson, Prof. J. J.** (New York City). Specimens of crude and distilled petroleum (exchange). 23205, 23140.

**Stevens Institute of Technology** (Hoboken, New Jersey), (through Dr. Henry Morton, President). Original drawings, made by Mr. Robert Fulton, of the steamboats *Clermont* and *Chancellor Livingston*, and framed label describing them. 23057.

**Stevenson, Mrs. T. E.** Twelve anthropological specimens from the Navajo Indians. 23123.

**Stewart, Henry E.** (Washington, District of Columbia). Living specimen of Brown Leghorn cock. 22752.

**Stinemetz, Samuel** (Washington, District of Columbia). White Fan-tail Pigeon; Black-barred Blue-winged Swallow Pigeon; Ice Pigeon, and Fairy Swallow Pigeon (22386); Red-winged Swallow Pigeon, in flesh (22491); Scotch Fan-tail Pigeon, in flesh (22505); White-barred Red-winged Swallow Pigeon, in flesh (22527); Blue-winged Swallow Pigeon (22804).

**Stone, Mrs. Elizabeth** (Washington, District of Columbia). Lace pillow with mahogany stand complete, with specimens of lace made by Mrs. Stone; lace pillow without stand; specimen of bobinet lace; ornamental bead-work; bags; necklaces; pair of Chinese shoes; two pairs of mocasins made by the Oneida Indians; pair of mocasins and one work-bag made by the Dakotas; pair of unmade slippers embroidered by Indians; highly polished steel paper-cutter (Mexican); rule made of ironwood taken from the old Government House at St. Augustine; box containing tusks with ornamental etchings of classical and other figures. 23319.

**Storer, Dr. H. R.** (Newport, Rhode Island). One hundred and twenty-six molds of medals for impressions to be made (lent). 22703.

**Strode, Dr. W. S.** (Bernadotte, Illinois). Specimen of *Ancistrodon contortrix*. 22288.

**Strong, J. C.** (Morantown, Kansas). Mounted specimen of *Mephitis putorius*. 22707.

**Stuart, Dr. Allen** (Beaufort, South Carolina), (through Hon. Edwin Willits and Mr. Walter Hoxie). Living specimen of otter. 22245.

**Sulzberger, D.** (Philadelphia, Pennsylvania). Two sets of phylacteries (22325); Hebrew Pentateuch manuscript (synagogue roll), cloak and pointer (deposit) (23147); manuscript tablet for numbering the period between the Passover and Pentecost (deposit) (23302).

**Surber, Thad.** (White Sulphur Springs, West Virginia). Specimens of flint implements and bones, taken from a neighboring mound; scrapers; spear-points; arrow-points, and fragments of bone. 22770.

**Sutphen, DeWitt C.** (See under Grand Commandery Knights Templar of the State of Nebraska.)

**Swan, James G.** (Port Townsend, Washington). Tooth of Mastodon (*Elephas primigenius*); head of Porpoise (*Phocæna communis*); ear bones of Whale (*Megaptera versabilis*); specimens of shells and fossils from the vicinity of Port Townsend;

SWAN, JAMES G.—Continued.
model of wicker fish-trap, and specimens of iron and lignite (22792); photograph of Mr. Swan, vice president of Pioneer Society of Washington at the inauguration of the new State of Washington at Olympia, November 18, 1889 (22833).

SWIFT, Hon. JOHN F., United States minister. (See under Hiramatz Rei.)

SWITZERLAND, GOVERNMENT OF (Federal Department of Industry and Agriculture, Berne, Switzerland), (through U. S. Department of State, Maj. Karl Kloss, chargé d'affaires *ad interim*, legation of Switzerland). Eighty-nine alcoholic specimens, representing 45 species of fishes. 22298.

SYPHER & COMPANY (New York City). Jewish lamp (purchase). 22334.

TAPPAN, OGDEN H. (Potsdam, New York). Specimen of Potsdam sandstone. 22887.

TARR, E. F. (McCarty's, New Mexico). Two Horned Toads (*Phrynosoma hernandezi*). 23159.

TAWNEY, PERRY (Gettysburgh, Pennsylvania). Block of granite, from the quarries of Tawney and Roach, near Culp's Hill, on the site of the battlefield of Gettysburgh. 22883.

TEGENER, FRITZ (Austin, Texas). Two specimens of gadolinite from Llano County. (purchase.) 22212.

THE PHOTOGRAVURE COMPANY (New York City). Twelve specimens and one duplicate of work done by a new photo-lithographic process—the Osborne process, modified for grain work. 23176.

THOMAS, Mr. (See under Mumley and Thomas.)

THOMAS, Rev. H. H. (Knowlesville, New York). Large slab of sandstone showing mud cracks (exchange) (23338); slab of Medina sandstone with fossil wood embedded in it. (23249).

THOMAS, W. H. (Knoxville, Tennessee). Top of telegraph pole with old-fashioned square glass insulator; old telegraph bracket with square glass insulator, and telegraph bracket with old-style round glass insulator. 22820.

THOMAS, W. S. (Hewitt's, North Carolina). Specimens of rutile from Swain County. 22725.

THOMPSON, ERNEST E. (Toronto, Canada). Mammal skins, including *Lepus sylvaticus*, *Arctomys monax*, *Sciurus leucotes* (melano), *Sciurus hudsonius*, *Tamias lysteri*, *Hesperomys leucopus*, *Arvicola riparius*, *Erethryson dorsatus*, and *Blarina brevicauda* (exchange) (22850); 15 specimens, representing 8 species of birds' skins, from Ontario (22947).

THOMPSON, J. H., jr. (Patterson, New York). Specimen of Barred Plymouth Rock hen. 23012.

THOMPSON, Dr. W. (San Bernardino, California). Specimen of a limbless lizard of the species *Aniella pulchra*, peculiar to California. 23263.

THOMSON, Paymaster WILLIAM J. (U. S. Navy). Easter Island tablets of wood, containing the hieroglyphic writing of that island. 23098.*

TIFFANY & CO. (New York City). Silvered-copper electrotype of the Bryant vase. 22581.

TOKUNO, T. (Chief of the Insetsu Kioku, Tokio, Japan). Thirteen specimens of pigments used by the Japanese printers of chromoxylographs. 23218. (See under Insetsu Kioku.)

TOMS, Capt. M. C. (Hendersonville, North Carolina). Specimen of polycrase (22347); specimens of zircon crystals, from Green River Zircon mines (purchase) (22585).

TONNET, ALONZO (Washington, District of Columbia). Specimen of Mockingbird (*Mimus polyglottos*), in flesh. 22248.

TOMBERS, T. G. (La Grange, Tennessee). Spear-point. 22183.

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* These tablets are among the rarest and most precious of all relics from the Polynesian area. Only five other specimens are known in the world. All attempts to decipher them up to this time have failed.

TOURTELETTE, Mrs. J. H. (Minersville, California), (through J. S. Diller, U. S. Geological Survey). Two specimens of native gold, associated with calcite from a mine on Digger Creek. 22693.

TOWNSEND, CHARLES H. (U. S. Fish Commission steamer *Albatross*). Two hundred and sixty-six specimens of birds, collected by the naturalists of the *Albatross* on the west coast of North America (22862); 15 skins and skulls of North American mammals (purchase). (22924.)

TOZZETTI, Prof. TARGIONI (Firenze, Italy). Thirty-one specimens, representing 8 species, of European microlepidoptera, and 29 specimens, representing 8 species of European orthoptera (exchange). 22823.

TREASURY DEPARTMENT, U. S.:

COAST AND GEODETIC SURVEY, U. S. (Through Prof. T. C. Mendenhall, Superintendent). Specimens of Indian bones and pottery, from Peru Landing (formerly Hatches Point), New River, North Carolina (collected by Mr. W. C. Hodgkins, assistant superintendent). 23255. (See under W. G. Henry.)

LIFE-SAVING SERVICE, U. S. (Hog Island, Virginia). Specimen of Harbor Seal (*Phoca vitulina*), in flesh, collected by Mr. R. O. Joynes, surfman. 23088.

MYERS, A. H. (life-saving station, Quoddy Head, Maine). Two photographs of *Balænopter arostrata.* 22420.

REVENUE MARINE SERVICE, U. S. (See under Capt. M. A. Healy, U. S. Revenue Marine steamer *Bear.*)

TRUE, F. W. (U. S. National Museum). Specimen of female Ermine (*Putorius erminea*) and 3 new-born specimens of the same species. 23050.

TRUMBLE, ALFRED (New York City). Impression from an intaglio engraving on wood. 22519.

TUCKER, CLARENCE (Syracuse, New York). Specimens of specular iron ore and micaceous specular iron ore from New York. (22721, 22829.)

TYLER, F. L. (Frankfort, Maine). Builder's skeleton model of top-sail schooner. 22662.

ULKE, HENRY (District of Columbia). Eighteen specimens, representing 4 species, of Mexican coleoptera, and 44 specimens, representing 18 species, of North American coleoptera, all mounted. 23031.

ULMAN, Mrs. B. F. (Baltimore, Maryland). Set of fringes for Jewish ceremonial garment, from Jerusalem. 23228.

UNITED STATES ECLIPSE EXPEDITION TO AFRICA (through Mr. William Harvey Brown). Alcoholic and dry shells, from Africa and Cape Verde Islands; alcoholic and dry birds; alcoholic birds for skeletons; alcoholic crustacea, echinoderms, and worms from Azores and Cape Verde Islands; alcoholic specimens of tortoises, snakes, and lizards; mammal skins and alcoholic specimens of mammals from Cape Town, Elmina, Cunga, and Cape Horn; alcoholic specimens of seaweed; alcoholic and dry insects; plants; ethnological objects; birds' eggs; specimen of chalcopyrite from Ascension Island; specimen of limestone, from Barbados, and pieces of lava from Porto Grande and Horta, Fayal, Azores Islands; fish trap and spear; specimens of fishes from Horta, St. Vincent, (Azores Islands), Freetown, Elmina, Cape Town, Cunga, St. Paul Loanda (Africa), and Ascension Island. 23272.* (See under Rev. G. H. R. Fisk.)

UNIVERSITY OF ABERDEEN. (Aberdeen, Scotland), (through Mr. Robert Walker, Librarian of the University). Two casts of fire-making implements. 22502.

UNIVERSITY OF THE STATE OF NEW YORK. (See under New York, University of the State of.)

UPHAM, E. P. (U. S. National Museum). Four quartzite implements found on Blagden's Hill, Piney Branch, District of Columbia. 22320.

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* The Curators of the departments to which the collections relate are preparing reports. These will be published in the "Proceedings of the National Museum." A preliminary report will be found in section I of the report under the head of Explorations.

**VAIL, Mrs. AMANDA** (New Britain, Connecticut). Two specimens of wire used in experiment of laying wires in pipes in the ground, and a specimen of wire used in the first practical experiment of telegraph at Speedwell, New Jersey, which afterwards transmitted the message "What hath God wrought." 23286.

**VAN NORDEN, R. T.** (San Francisco, California). Photograph of an inscribed stone found at Yarmouth, Nova Scotia. 22629.

**VARLEY, THOMAS** (Woodwardville, Maryland). Specimens of arrow-points and fragments of pottery from Anne Arundel County. 22678.

**VATHELET, Rev. A.** (Maisières par Lafertè, Haute Morne, France). Eighty-eight specimens, representing 30 species, of shells from Japan, Tonkin, and other localities. 22506.

**VANDERHOEF, LORENZO** (District of Columbia). Pierced tablet of striped slate found in Medina County, Ohio. 22732.

**VAN RENSSELAER, Mrs. J. KING** (New York City). Pack of Japanese playing cards (23174); pack of Italian playing cards, and a set of Chinese dominoes (230[illegible]).

**VAUX, GEORGE, Jr.** (Philadelphia, Pennsylvania). Specimens of fluorite, orpiment, limonite, phenakite, amarantite, malachite, pseudomorph after azurite spessartite in rhyolite, jarosite, chalcopyrite crystals, siderontrite, polished [illegible] of blue smithsonite, and a pyrite octahedron from various localities. 232[illegible].

**VESTERLUND, OTTO** (Killarney, Florida). Specimens of dried plants and insects mostly Coleoptera and Lepidoptera. 22304.

**WADDEY, B. F.**, (Alexandria, Virginia). Specimen of *Ancistrodon contortrix*. 2316[illegible].

**WAGNER FREE INSTITUTE OF SCIENCES** (Philadelphia, Pennsylvania). Specimens of selenite from St. Mary's County, Maryland. 23238.

**WALCOTT, CHARLES D.** (U. S. Geological Survey). Forty-eight specimens, representing 9 genera and 11 species of Paleozoic fossils as follows: Middle Cambrian *Ptychoparia king*, Walcott. Upper Cambrian: *Acrothele subsidua* White, *Agnostus interstrictus* White, *Asaphiscus wheeleri* Meek. Upper Silurian: *Halysites catenulatus* Linn, Lingula sp.? and one unidentified specimen. Devonian: *Strophodonta calvini* Miller, *S. canace*, H. & W., *S. variabilis*, Calvin, and *Rhynchonella alta*. 22776. (See under Interior Department, U. S. Geological Survey.)

**WALKER, BRYANT** (Detroit, Michigan). Four species and varieties of physas from Michigan. 22247.

**WALKER, Commodore J. G.** (U. S. Navy). (See under Navy Department.)

**WALKER, LAWSON, & FORNEY** (Allisonia, Virginia). Specimens of zinc ores from Pulaski County. 23215.

**WALKER, ROBERT.** (See under University of Aberdeen).

**WALTER, Rev. Father** (Washington, District of Columbia). Model of house, specimen of pottery from Cochite, Santa Domingo, and Santa Clara, birch-bark flower vases, birch-bark boxes, old Spanish cross inlaid with straw, pair of child's moccasins (Pueblos), and beaded stole (22209); specimen of hair work made by the Winnebago Indians at the Catholic school (deposit). (22467.)

**WAR DEPARTMENT, U. S.** Two swords presented to the late Gen. James Shields, by the States of South Carolina and Illinois, for gallant services in the Mexican war (deposit). 22876.

**WARD & HOWELL** (Rochester, New York). Three specimens, representing 3 genera and 3 species of Silurian trilobites, *Ogygia guettardi* Brongniart, *Asaphus expansus* Dolman, and *Illænus giganteus* Brongniart (exchange) (22740); 2 specimens of meteoric iron, from Puquios, Chile, and Erath County, Texas (23268).

**WARD, Miss ANNA L.** (Waterbury, Connecticut). Model of seal-skin Igloo of the Eskimo, seal-skin coat, seal-skin tobacco pouch, pair of seal-skin kumings (infant's shoes), a bag of feathers from Hopedale, Labrador, and 2 mounted seals. 23204.

**WARD, Prof. H. A.** (Rochester, New York). Skull of Bornean Crocodile *Tomistoma schlegeli* (exchange) (22835); skeletons of Little Penguin (*Eudyptilia* min and Gratsueker (*Podargus*); specimens of *Ceratodus* and King Penguin (*Apte*

Ward, Prof. H. A.—Continued.
*dytes Pennanti*) (22901); 20 glass models of invertebrates (purchase) (22902); 2 specimens of West Indian seals, in exchange (purchase) (23608).

Ward, John T. (Washington, District of Columbia). Living specimen of *Strix pratincola*. 23220.

Ward, Dr. William H. (New York City). Twelve Assyrian and Babylonian seals. (lent) 22326.

Warren, Dr. B. H. (West Chester, Pennsylvania). Specimens of mammal skins, comprising Wood Hare (*Lepus sylvaticus*), Varying Hare (*Lepus americanus*), Red Squirrels (*Sciurus hudsonius*), and Ermine (*Putorius erminea*) 22789.

Warren, C. W. (New York City). Two specimens of brucite with serpentine from Hoboken, New Jersey. 22353.

Watkins, J. Q. (Zincite, Missouri). Photograph of a large mass of galena from the zinc and lead mines of De Graff & Watkins. 23232.

Watson, Joshua (Sedgwick, Maine). Builder's model of schooner and brig. 22660. (See under W. H. Abbott.)

Wayne, Arthur T. (Charleston, South Carolina). Three specimens, representing 3 species of birds' skins from New Mexico and South Carolina. 22701.

Webb, John S. (Disputanta, Virginia). Specimen of insect *Danais plexippus* (22197); specimen of Great Blue Heron (*Ardea herodias*), in flesh (23095).

Webb, F. & Co. (Philadelphia, Pennsylvania). Two copies of illustrative catalogues and a price list of artists' materials. 22554.

Webster, George W. (Lake Helen, Florida). Thirty-three species of marine, land and fresh-water shells from southeastern Florida. (22434, 23043.)

Webster, Prof. H. E. (See under Wesleyan University.)

Weidenbach, H. (Gales Woods, Northeast Washington, District of Columbia). Specimen of quartz pebble from Cologne on the Rhine, Germany. 22366.

Welch, Charles. (See under Guildhall Library Committee.)

Welch, William (West Pembroke, Maine). Builder's model of two-masted schooner. 22650. (See under W. H. Abbott.)

Welker, W. W. (Liverpool, Pennsylvania). Small collection of archæological objects, consisting of pestles; small celt; notched sinkers; arrow-heads, and perforated stone (natural formation) from Perry County (exchange). 23085.

Wesleyan University (Middletown, Connecticut). A collection of annelids, from Bermuda, gathered by Dr. G. Brown Goode, and identified by Prof. H. E. Webster, formerly of the University of Rochester and now president of Union College, Schenectady, New York.*

Westerman, B. & Co. (New York City). Relief map of Palestine. 22351.

Western Normal College. (See under Prof. A. H. Conrad.)

Westfall, J. W. (See under William W. McCully and Captain Z. Wood.)

Wharton, Dr. J. E. (Phœnix, Arizona). Specimens of azurite; azurite altering to malachite, from the "Copper Queen" mine, Bisbee, and a specimen of wolframite, from Cave Creek, Maricopa County (collected by Dr. W. F. Hillebrand, of the U. S. Geological Survey). 22534.

White, Dr. C. A. (U. S. National Museum). Engraved portrait of Prof. Dr. Gerrhard von Rath. 22615.

White, Dr. C. H. (Medical Inspector, U. S. Navy). Specimens of butterflies, from Apia, Samoa (22337). (Through Dr. G. W. Woods, medical inspector, U. S. Navy, Mare Island, California). Skin of a bat (*Pteropus sp.*) and 9 birds' skins, from Samoa; alcoholic specimens of reptiles; alcoholic specimens of fishes from Samoa, comprising *Balistes*, *Chætodon*, *Caranx*, *Acanthurus*, *Pomaventrus*, *Gerres*, *Pempheris*, *Periophthalmus*, *Lutjanus*, and several species of *Labroids;* alcoholic, specimens of insects, mostly orthoptera, spiders, and myriapods; alcoholic specimens of marine invertebrates, crabs, hermit crab, and shrimp (22499).

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* For a full description of this collection, see Bulletin 25 of the National Museum.

White, Mrs. Harriet A. R. (Buffalo, New York). Specimen of Carolina Parrakeet (*Conurus carolinensis*). 22266.

White, John C. (Bisbee, Arizona). Specimens of cuprite, calcite, and azurite altering to malachite from the "Copper Queen" mine (collected by Dr. W. F. Hillebrand, of the U. S. Geological Survey.) 22598.

White, J. J. (Palm Beach, Florida). Six species of fresh-water shells, from Crystal Lake, Benzie County, Michigan, and specimen of *Planorbis* from Lake Worth, Florida. 22665.

White, Robinson (Washington, District of Columbia). Two specimens of *Urocyon virginianus*, from Virginia. 22318.

Whitman, Dr. J. S. (Lyndon, Kansas). Specimen of *Blarina cinerea*. 23087.

Widman, O. (Old Orchard, Maine). Eggs of *Progne subis* and *Passer montanus*. 22860.

Wilcox, Glover P. (Fort Niobrara, Nebraska), (through Dr. Timothy E. Wilcox, U. S. Army). Vetebra of mastodon, alcoholic specimens of mammals, specimen of petrified wood, alcoholic specimen of snake, and pieces of bone and quartz. 23299.

Wilcox, Dr. Timothy E. (U. S. Army) (Fort Niobrara, Nebraska). (See under Glover P. Wilcox.)

Wilde, Commander George F. F. (U. S. Navy). (See under Navy Department.)

Willcox, Joseph (Academy of Natural Sciences, Philadelphia, Pennsylvania). Fresh-water sponge from the *Everglades*, Florida. 22734.

Williams, Dr. George H. (Johns Hopkins University, Baltimore, Maryland). Collection of rocks representing Pigeon Point contacts and Menominee River and Marquette greenstones from Michigan. 23145.

Williamson, Mrs. M. Burton (University, California). Specimen of *Periploma discus* from Monterey Bay, California (exchange) (23135); specimens of shells, from the coast of California (23266).

Willis, Merritt (West Farms, New York). Prehistoric stone implements from Illinois and Westchester, New York. 22232.

Willits, Hon. Edwin (Assistant Secretary of Agriculture). (See under Dr. Allen Stuart.)

Williams, Mr. ——— (Great Falls, Montana). Eggs and nest of *Sayornis saya* Bonap. 22213.

Wilson, George M. (Mullan, Idaho). Specimen of pyromorphite on limonite from the "Little Giant" mine, Shoshone County. 22463.

Wilson, Miss Nellie E. (Washington, District of Columbia). Specimens of flint implements, etc., from France and England; obsidian cores from the Island of Milo, Greece, and a bronze hatchet and fragment of a copper implement from Peru. 22523.

Wilson, Mrs. Thomas (Washington, District of Columbia). Five specimens of paleolithic implements, from Piney Branch. 22279.

Willson, J. M. (Kissimmee, Florida). Specimen of Katydid (*Phylloptera oblongifolia*) remarkable for its red color. 22270.

Wimeschke, R. (Elkin, North Carolina). Specimen of Lizard. 22322.

Wimsatt, R. D. and Louis B. Johnson (Washington, District of Columbia). Specimens of Fish Crow (*Corvus ossifragus*) from Virginia (22879, 22965).

Windsor, F. R. (Alexandria, Virginia). Specimen of Great Horned Owl (*Bubo virginianus*) from Fairfax County. 23048.

Winkler, Dr. C. (Germany), (through Prof. F. W. Clarke, of the U. S. National Museum). A specimen of germanium, a new metal discovered by Dr. Winkler in 1886, near Frieberg.* 22990.

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* This specimen was prepared by Dr. Winkler. It is of a grayish-white, lustrous, crystalline, brittle metal, easily pulverized, unchanged in air, and soluble in *aqua regia* regia; it also fuses readily.

**Winkley**, Rev. H. W. (Saco, Maine). Specimen of *Odostomia seminuda*, and other species from Summerfield, Prince Edward Island, Alaska. 23003.

**Winter**, W. J. (Denver, Colorado). Ribbon badge of the "Cowboy Club." 22307.

**Winton**, Rev. **George** B. (San Luis Potosi, Mexico). Specimen of *Phainopepla nitens* (22881); 3 specimens, representing 3 species of birds in flesh (22926).

**Witherbees, Sherman** & Co. (Port Henry, New York). Thirty-nine specimens of crystals from Mineville (22435); (through Mr. John Birkenbine, and Dr. David T. Day, U. S. Geological Survey) a large specimen of magnetite (23000).

**Wolf**, Dr. J. L. (Washington, District of Columbia). Living specimen of Screech Owl. 22684.

**Wolfe**, M. (Dayton, Ohio). Seven specimens of half-tone relief-work made with the donor's fine line plates. 23080.

**Woltz, George** W. (U. S. National Museum). Specimen of stalactite from Fort Washington, Maryland. 22702.

**Wood, Nelson** R. (U. S. National Museum). Specimens of birds in flesh, killed by flying against the Washington Monument (22370, 22398, 22401); Sumatra Gamecock and Game-chickens (23101, 23180).

**Wood**, Capt. Z. (through Mr. J. W. Westfall, U. S. National Museum). Specimens of *Ostrea virginica* and *Mytilus hamatus* attached to a clay pipe, found in the Potomac River. 22381.

**Woods**, Dr. G. W. (U. S. Navy). (See under Dr. C. H. White, U. S. Navy.)

**Wooster**, A. F. (Norfolk, Connecticut). Two specimens of insects, *Lucanus dama* Fabr. and *Orthosoma brunneum* Fabr. (22458); specimens of land-shells (22613); picture painted on mica by a native of India (22667); copper coin (cinco centimos) of the Republic of Spain, 1870 (23015).

**Worley**, Dr. S. G. (Kissimmee, Florida.) Larva of a Geometrid moth (*Aplodes rubivoraria*, Pack). 22240.

**Worth**, S. G. (See under Carolina Wood Veneer Works.)

**Worthen, Charles** K. (Warsaw, Illinois). Nineteen specimens of skins and skulls of *Arvicola*, *Hesperomys*, *Putorius brasiliensis*, *Froenatus*, *Spermophilus*, and *Neotoma* (purchase). 22300.

**Wright, Albert** A. (See under Oberlin College.).

**Wright**, D. W. M. (Holly Brook, Virginia). Specimen of limonite. 22961.

**Wunderlich**, H., & Co. (New York City). Pure line-engraving, by H. Goltzius, "The Massacre of the Innocents" (22416); engraving (imitation crayon) of "The Peasant Girl," by Demarteau (23280).

**Yarrow**, Dr. H. C. (Washington, District of Columbia). Specimen of *Uranidea richardsoni* from Virginia. 22211.

**Yeates, William** S. (U. S. National Museum). Fifteen specimens of rutile, specimen of rutile in quartz, and 2 crystals of smoky quartz from Hiddenite, North Carolina (22185); 620 specimens of kyanite from Black Mountain, Buncombe County, North Carolina (22220). (See under Ira B. Allen, Mrs. Hilda Burdick, W. E. Hidden, U. S. National Museum.)

**Yoder**, J. E. (Lynchburgh, Virginia). Specimens of loose rutile crystals and loose crystals of limonite pseudomorph after pyrite. 22724.

**Young**, C. L. (Lamoine, Maine). Builder's model of two-masted brig. 22655. (See under W. H. Abbott.)

**Young, Joseph** (Bellevue, Iowa). Arrow-head from Iowa. 22774.

**Yount, Fred** (District of Columbia). Specimen of Racoon (*Procyon lotor*). 23164.

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